

**ABSTRACTS OF MECHANICAL AND ELECTRICAL ENGINEERING
OBTAINING THE CHARACTERISTICS OF SMALL AND VERY SMALL SPAN WINGS**

Beazit ALI¹
Deniz UNSALAM²
Adriana SPORIŞ³
Filis TULEI⁴

¹ Senior lecturer.PhD. Beazit Ali, „Mircea cel Batran” Naval Academy

² Prof.Ph.D , Dokuz Eylul University, Iatanbul, Turkey

³ Lecturer Ph.D.Adriana Sporiş, „Mircea cel Batran” Naval Academy

⁴ Prep.univ.ing Filis Tulei, „Mircea cel Batran” Naval Academy

Abstract: This scientific work presents the way in which the small and very small span wings can be obtained starting from the great span wings and using the two scales of the similarity theory. Basing on two scales model it can transcribe from model at nature the coefficients c_x , c_y and lengthening λ of GOTTINGEN- 612 profile.

Key words: span wings

1. INTRODUCTION

In the following we will set out the coordinates (polars) of wings of small and very small elongation, which can be obtained starting from the coordinates of the wings of big elongation, if the theory of similitude is used at two scales. In order to obtain this it is necessary to transcribe from model to nature the coefficients c_x , c_y and elongation λ , according to the model at two scales of the wing.

2. TRANSCRIPTION OF THE COEFFICIENTS c_x , c_y AND c_M ACCORDING TO THE MODEL AT TWO SCALES

In the case of the rectangular wing in a plane, having string c constant all along the span (in this case the wing is called aerodynamically twisted with the angle of attack variable along the span) the surface of the wing is determined with the relation:

$$S = c \cdot l \tag{1}$$

The relative elongation of the wing is:

$$\lambda = \frac{l^2}{S} = \frac{l^2}{l \cdot c} = \frac{l}{c} \tag{2}$$

Since $K_l = K_z$ și $K_c = K_x$ the elomgation scale is:

$$K_\lambda = \frac{K_l}{K_c} = \frac{K_z}{K_x} = \frac{\lambda_n}{\lambda_m} = K_1 \tag{3}$$

Since $K_l = K_z$ și $K_c = K_x$ th escale of the elongation is:

$$\lambda_n = K_1 \cdot \lambda_m ; K_1\text{- distort ratio} \tag{4}$$

from which results the relation of elongation transcription:

$$\lambda_n = K_1 \cdot \lambda_m ; K_1\text{- distort ratio}$$

If we write the wing's bearing force like:

$$R_y = c_y \cdot S \cdot \frac{\rho \cdot v^2}{2} \tag{5}$$

We have:

$$K_R = K_{R_y} = K_{c_y} \cdot K_S \cdot K_\rho \cdot K_v^2 = K_{c_y} \cdot K_z \cdot K_x \cdot K_\rho \cdot K_v^2 \tag{6}$$

The scale of the forces can also be written like:

$$K_R = K_{R_y} = K_1^2 \cdot K_\rho \cdot K_v^2 \cdot K_x^2 = K_\rho \cdot K_z^2 \cdot K_v^2 \tag{7}$$

And by the equalization of the relations (6) and (7) we get:

$$K_{c_y} \cdot K_z \cdot K_x \cdot K_\rho \cdot K_v^2 = K_\rho \cdot K_z^2 \cdot K_v^2 \tag{8}$$

hence resulting the scale of the unitary coefficient of the bearing force:

$$K_{c_y} = \frac{c_{y_n}}{c_{y_m}} = \frac{K_z}{K_x} = K_1 \tag{9}$$

having thus:

$$c_{y_n} = K_1 \cdot c_{y_m} \tag{10}$$

The advance resistance being:

$$R_x = c_x \cdot S \cdot \frac{\rho v^2}{2} \tag{11}$$

And taking into account the relation (8), because the scale of forces is dependent on their nature we can write:

$$K_R = K_{R_x} = K_{c_x} \cdot K_z \cdot K_x \cdot K_\rho \cdot K_v^2 = K_\rho \cdot K_z^2 \cdot K_v^2 \tag{12}$$

from which results the relation:

$$K_{c_x} = \frac{c_{x_n}}{c_{x_m}} = \frac{K_z}{K_x} = K_1 \tag{13}$$

having:

$$c_{x_n} = K_1 \cdot c_{x_m} \tag{14}$$

As it is known for a given profile the coefficients c_x , c_y and c_M are functions of the incidence angle α , and the criteria of similitude Re , Fr , Sh and Eu ; also, the covement conditions of the wing in the unlimited fluid or in the vicinity of a solid or fluid surface have a great influence.

Let's examine now the scale of c_M in conditions of similitude at two scales, with small angles of attack. In this case we can write the relation:

$$M = R_y \cdot e \tag{15}$$

In which e represents the distance from the pressure centre of the profile to its board of attack.

So, we can write:

$$K_M = K_R \cdot K_c = K_\rho \cdot K_v^2 \cdot K_z^2 \cdot K_x \tag{16}$$

and

$$K_M = K_{c_M} \cdot K_\rho \cdot K_z \cdot K_x \cdot K_v^2 \cdot K_x \tag{17}$$

Equalizing (16) cu (17) we get:

$$K_\rho \cdot K_v^2 \cdot K_z^2 \cdot K_x = K_{c_M} \cdot K_\rho \cdot K_z \cdot K_x^2 \cdot K_v^2 \tag{18}$$

By the help of the relations (3), (10), (14),and (20) it is possible to transcribe the nondimensional λ , c_y , c_x and c_M from the model to nature, which as seen, have in nature the values from the model multiplied by the distortion ratio K_1 . Being nondimensional, these coefficients vary to the same extent when they shift from model to nature.

From which results:

$$K_{c_M} = \frac{(c_M)_n}{(c_M)_m} = \frac{K_z}{K_x} = K_1 \tag{19}$$

Or:

$$(c_M)_n = K_1 (c_M)_m \tag{20}$$

We should also say that in order to obtain the nature wing's hydrodynamic coefficients we can also use the following formula. If we write the speed on the model like:

$$v_m = \frac{Re_m \cdot v_m}{c_m} \tag{21}$$

And having known that between the speed of the nature wing and model wing is the following relation of similitude:

$$v_n = v_m \cdot \frac{K_x}{\sqrt{K_z}} \tag{22}$$

we get:

$$v_n = \frac{Re_m \cdot v_m \cdot \frac{c_n}{c_m}}{\sqrt{\lambda_m \cdot c_m}} \quad (23)$$

from which:

$$v_n = \frac{Re_m \cdot v_m \cdot c_n \cdot \sqrt{\lambda_m \cdot c_m}}{c_m^2 \sqrt{l_n}} \quad (24)$$

or:

$$\frac{\sqrt{c_m}}{c_m} = \frac{v_n \cdot \sqrt{l_n}}{Re_m \cdot v_m \cdot c_n} \quad (25)$$

$$c_m \sqrt{c_m} = \frac{Re_m \cdot v_m \cdot c_n \cdot \sqrt{\lambda_m}}{v_n \cdot \sqrt{l_n}} \quad (26)$$

obtaining in this way the relation of determination of the model's string's length c_m :

$$c_m = \sqrt[3]{\left(\frac{Re_m \cdot v_m \cdot c_n \cdot \sqrt{\lambda_m}}{v_n \cdot \sqrt{l_n}}\right)^2} \quad (27)$$

Using the definition relation of the relative elongation we can determine the span of the model wing:

$$l_m = \lambda_m \cdot c_m \quad (28)$$

We calculate the scale of the string K_c and the scale of the span K_l :

$$K_c = K_x = \frac{c_n}{c_m} \quad (29)$$

$$K_l = K_z = \frac{l_n}{l_m} \quad (30)$$

We determine the distortion ratio K_1

$$K_1 = \frac{K_l}{K_c} = \frac{K_z}{K_x} \quad (31)$$

We state the scales of density, speed, and force.

$$K_\rho = \frac{\rho_n}{\rho_m} \quad (32)$$

$$K_v = \frac{K_x}{\sqrt{K_z}} = \frac{v_n}{v_m} \quad (33)$$

$$K_R = K_\rho \cdot K_x^2 \cdot K_z = \frac{R_{y_n}}{R_{y_m}} = \frac{R_{x_n}}{R_{x_m}} \quad (34)$$

Both the model and the real wing are rectangular in plan and we can determine, with the known data the areas of the surfaces:

$$S_m = l_m \cdot c_m \quad (35)$$

$$S_n = l_n \cdot c_n \quad (36)$$

According to the law of the model we calculate the speed of the nature (real) wing:

$$v_n = v_m \cdot K_v = v_m \cdot \frac{K_x}{\sqrt{K_z}} \quad (37)$$

With the known data we can further determine the bearing force of the model wing:

$$R_{y_m} = c_{y_m} \cdot S_m \cdot \frac{\rho_m \cdot v_m^2}{2} \quad (38)$$

Using the law of model or the relation (07), we will calculate the bearing force of the real wing:

$$R_{y_n} = K_R \cdot R_{y_m} = K_x^2 \cdot K_z \cdot K_\rho \cdot R_{y_m} \quad (39)$$

From which the coefficient of the real wing bearing force:

$$c_{y_n} = \frac{R_{y_n}}{S_n \cdot \frac{\rho_n \cdot v_n^2}{2}} \quad (40)$$

We calculate the advance resistance of the model wing:

$$R_{x_m} = c_{x_m} \cdot S_m \cdot \frac{\rho_m \cdot v_m^2}{2} \quad (41)$$

and on the basis of the law of model we get the advance resistance of the real wing:

$$R_{x_n} = K_R \cdot R_{x_m} = K_\rho \cdot K_x^2 \cdot K_z \cdot R_{x_m} \quad (42)$$

From which the coefficient of advance resistance of the real wing is deduced:

$$c_{x_n} = \frac{R_{x_n}}{S_n \cdot \frac{\rho_n \cdot v_n^2}{2}} \quad (43)$$

In conclusion, taking into account what we have mentioned before, we can say that the values of the coefficients c_{y_n} și

c_{x_n}

Of the real nature) wing do not depend on the dimensions of the model wing; they depend only on the relative elongation of the wing, and for every single elongation of the wing only one polar is established.

It is true that if we extend the relations (10) and (14.) we get:

$$c_{y_n} = c_{y_m} \cdot \frac{K_z}{K_x} = c_{y_m} \cdot \frac{l_n}{c_n} = c_{y_m} \cdot \frac{\lambda_n}{\lambda_m} \quad (44)$$

$$c_{x_n} = c_{x_m} \cdot \frac{K_z}{K_x} = c_{x_m} \cdot \frac{l_n}{c_n} = c_{x_m} \cdot \frac{\lambda_n}{\lambda_m} \quad (45)$$

This is to confirm once more that within the relations between coefficients the dimensions of model wing do not interfere.

3. TRACING THE GOTTINGEN – 612 PROFILE'S POLAR WITH RELATIVE ELONGATION $\lambda = 3$, KNOWING THE CORRESPONDING PROFILE'S POLAR CORRESPONDING TO THE RELATIVE ELONGATION $\lambda = 5$

The string's length $c_n = 0,3$ m and the ship's speed $v_n = 25$ m/s is considered for the nature wing. We also stress that the initial polar was drawn in the aerodynamic tunnel, an the small span wing under observation will function in water.

Cinematic viscosity values of the two fluids are:

$$v_{aer} = 0,0000143 \frac{m^2}{s} \quad v_{apa} = 1,191 \cdot 10^{-6} \frac{m^2}{s}$$

Thus, for the $c_n = 0,3$ m, $v_n = 25 \frac{m}{s}$ and $v_{apa} = 1,191 \cdot 10^{-6} \frac{m^2}{s}$ there results:

$$Re_n = \frac{v_n \cdot c_n}{v_{apa}} = \frac{25 \cdot 0,3}{1,191 \cdot 10^{-6}} = 6,27 \cdot 10^6 \quad (46)$$

$Re_n = 6.300.000$.

The GOTTINGEN-612 profile is characterized by: $\lambda_m = 5$ and $Re_n = 420.000$. The following data are to be found in the specialty literature (see table 1)

Table No. 1

| α | C_{ym} | C_{xm} |
|----------|----------|----------|
| - | - | 0,0796 |
| 10,4 | 0,340 | - |
| -8,9 | 0,250 | 0,0216 |
| -6,0 | 0,056 | 0,0096 |
| -3,0 | 0,141 | 0,0109 |
| -0,1 | 0,322 | 0,0159 |
| 2,8 | 0,526 | 0,0261 |
| 5,8 | 0,723 | 0,0437 |
| 8,7 | 0,900 | 0,067 |
| 11,6 | 1,044 | 0,0941 |
| 14,6 | 1,073 | 0,135 |
| 17,7 | 0,952 | 0,260 |

The distortion ratios for the three elongations $\lambda_{n_1} = 3$; $\lambda_{n_2} = 2$ și $\lambda_{n_3} = 1$

will be:

$$K_1' = \frac{\lambda_{n_1}}{\lambda_m} = \frac{3}{5} = 0,6 \quad K'' = \frac{\lambda_{n_2}}{\lambda_m} = \frac{2}{5} = 0,4 \quad ; \quad K''' = \frac{\lambda_{n_3}}{\lambda_m} = \frac{1}{5} = 0,2 \quad (47)$$

Using the equations obtained through the theory of similitude (10) and (14) we can draw up the table 2 for the nature wing with elongation $\lambda_{n_1} = 3$:

$$\lambda_{n_1} = 3; K_1' = 0,6; Re_n = 6.300.000. \text{ (see table no. 2).}$$

Table No. 2

| α | C_{ym} | C_{xm} |
|----------|----------|----------|
| - | -0,204 | 0,0477 |
| 10,4 | - | - |
| -8,9 | -0,15 | 0,0129 |
| -6,0 | -0,033 | 0,00576 |
| -3,0 | 0,091 | 0,0065 |
| -0,1 | 0,1932 | 0,0095 |
| 2,8 | 0,3156 | 0,0156 |
| 5,8 | 0,434 | 0,0262 |
| 8,7 | 0,54 | 0,0402 |
| 11,6 | 0,626 | 0,0564 |
| 14,6 | 0,644 | 0,081 |
| 17,7 | 0,5712 | 0,156 |

4. CONCLUSIONS

Going on in the same manner, that is starting from the polars of big span wings and using the theory of similitude at two scales, the polar, of other profiles (of small and very small span), which were analysed, can be built; for example: GOTTINGEN- 439, GOTTINGEN- 480, NACA- 4409, CLARK Y, RAF- 32, GOTTINGEN- 565, GOTTINGEN- 670, GOTTINGEN- 682, GOTTINGEN- 507, and NACA- 6412, (for $\lambda = 3$, $\lambda = 2$ and $\lambda = 1$).

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IMPLEMENTATION OF HAMMING CODES IN RECONFIGURABLE HARDWARE

Constantin ANTON¹
Ion TUTANESCU²
Gheorghe SERBAN³
Gabriel IANA⁴
Petre ANGHELESCU⁵

¹ General de brigadă în rezerva, doctor inginer, Universitatea din Pitești, Str. Targul din Vale, nr. 1, Pitesti, Romania

² Colonel, doctor inginer, Univeristatea din Pitești, Str. Targul din Vale, nr. 1, Pitesti, Romania

³ Doctor inginer, Univeristatea din Pitești, Str. Targul din Vale, nr. 1, Pitesti, Romania

⁴ Doctor inginer, Univeristatea din Pitești, Str. Targul din Vale, nr. 1, Pitesti, Romania

⁵ Doctor inginer, Univeristatea din Pitești, Str. Targul din Vale, nr. 1, Pitesti, Romania

Abstract: In this paper is hamming code proposed implementing a structure for reconfigurable hardware for error correction bits on a line of communication. Algorithms for implementing the hamming code is made on a structure as simple and is aimed at the trials of code/decode the information to perform at a speed as much as possible, without the special hardware consumes resources. They are made functional simulations of implemented module and comparative results speed/resources occupied for various lengths of sequences.

Keywords: Hamming code, hardware structure, communication, error correction, FPGA implementation

INTRODUCTION

In communications, transmission systems over must receive packets of information data without error, at high speeds and an architecture with a small complexity with a low costs. In cases where the environment of transmission is noisy, correcting for packages of data can use a method for retransmission of those packages which are incorrect. This method of interrogation and the retransmission data involve stroke large stakes in the transmission of data, in many cases being inefficient. To avoid this disadvantage, in some cases is used hamming code of errors correction.

Hamming Codes are generally used in computing, telecommunication, and other applications including data compression, and turbo codes. Also, the Hamming codes are used, for example, as forward correcting cedes in the Bluetooth standard, and to protect data stored in semiconductor memories. Hamming codes are used very well for low-cost, low-power application, and when decoded iteratively, they can approach the capacity of an additive white Gaussian noise (AWGN) channel.

The algorithm for calculating hamming code is one attractive, low and the complexity can be easily implemented in digital structures. For these reasons are fairly attractive with the implementation of some types of applications of high speed, the communications field.

HAMMING CODE THEORY

Hamming codes permits correcting single-bit errors. At k bit of information bits its used m the number of check. Because the m check bits must check themselves as well as the information bits, the value of p (parity check bit vector), interpreted as an integer, must range from 0 to $m + k$ which is $m + k + 1$ distinct values. All, the m bits can be distinguish at 2^m cases, as shown in equation 1.

$$2^m \geq m + k + 1 \quad (1)$$

It applies to any single error correcting (SEC) binary Forward Error Correction (FEC) bloc codes in which all of the transmitted bits must be checked.

The rate of the code defined the relationship k/n involving processing a higher number of bits of information to obtain rates close to 1. The hamming code has the power of correction little fact that involves the use of number of bits informational small. According to the noise of channel of communication, (p which means error probability of a symbol), we choose number of informational bits for noisiest channels ($p \ll$), we chose grow k . In figure 1, it is done an example where $p = 0.01$ (noisy channel), k can't be bigger as 11bits.

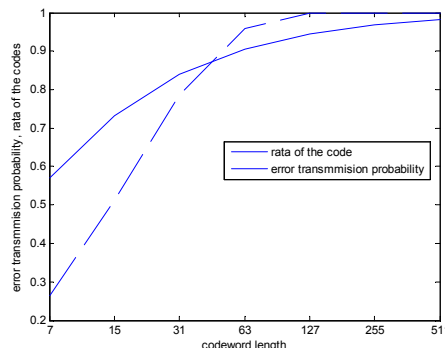


Figure 1. The calculation errors and probability rate code word depending on length of the Code

The check bits will be interspersed among the information bits in a manner described below.

Putting the check bits in positions 2^m has the advantage that they are independent. That is, sender can compute p_0 independently of p_1, p_2, \dots and more generally, it can compute each check bit independently of the others.

As an example, let us develop a single error correcting code for $k = 4$, solving (1) for m gives $m = 3$, with equality holding.

This means that all 2^m possible values of the check bits are used, so it is particularly efficient. A code with this property is called a perfect code.

This codes is called the (7,4) Hamming code, which signifies that the code length is 7 and the number of information bits is 4. In the figure 2 is plotted the throughput channel function probability of error where shown the efficiency of hamming code.

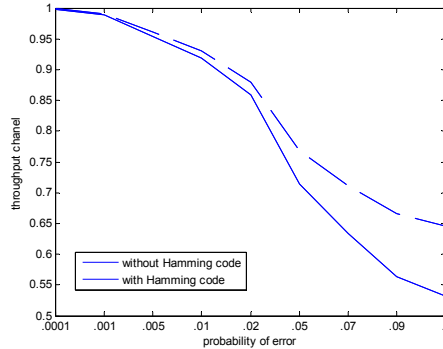


Figure 2. Throughput channel function probability of error - Hamming (7,4).

The positions of the check bits p_i and the information bits p_i are shown in figure 3.

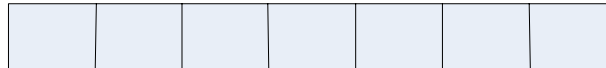


Figure 3. The positions of the check bits in the information bits string.

THE RECONFIGURABLE HARDWARE

Overview

The reconfigurable hardware comes from idea to change the internal interconnection of digital devices. First was introduced the Programmable Logic Devices (PLDs), Programmable logic array (PAL), Generic Array Logic (GAL) device that is a PAL devices but could be erased and reprogrammed. The needed of finite state machine implementation, was introduced the CPLD (Complex PLD) devices. CPLDs have a complexity that can replace very much of logic gates but these devices are not enough to implement complexes algorithm. Then was introduced Field Programmable Gate Array (FPGA). These devices have a different architecture of reconfiguration in comparison with CPLD. The FPGA is built using a grid of configurable logic blocs interconnected by array of wire. Those devices are capable to implement very complex algorithms.

The future tendency is it the developing Configurable System on Chip (CSoC). In this devices can be immersed the cores of processors and is combined the sped of FPGA data flow processing and capability of multiple task managing with the core processors

The implementation on hardware algorithms is made trough hardware description as Verilog, and especially, VHDL. Recently, FPGAs have been used for reconfigurable computing when the main goal is to obtain high performance at a reasonable cost out of hardware implemented algorithms. The main advantage of FPGAs is their reconfigurability, i.e., they can be used for different purposes at different stages of a computation and they can be, at least partially, reprogrammed on run-time.

The FPGA architecture

The architecture of Xilinx FPGA families consists of five fundamental functional elements:

- Configurable Logic Block (CLB) and Slice architecture;
- Input/Output Blocks (IOBs);
- Block RAM;
- Dedicated Multipliers and;
- Digital Clock Managers (DCMs).

The configurable Logic Blocs (CLBs) are the most important and abundant hardware resource of an FPGA. They are typically utilized for both, combinatorial and synchronous logic design. Each CLB is composed of four slices (figure 4).

The slices are grouped by pairs and each pair is organized by a column with independent carry chain. All four slices have the following common elements: two Look-Up Tables (LUTs), two type D flip-flops, multiplexers, logic circuits for carry handling and arithmetic logic gates. Both, the left and right pair of slices utilize those elements for providing logic functions, arithmetic and ROM. Besides that, the left pair supports two additional functions: data storage using a distributed RAM and 16-bit shift register functionality.

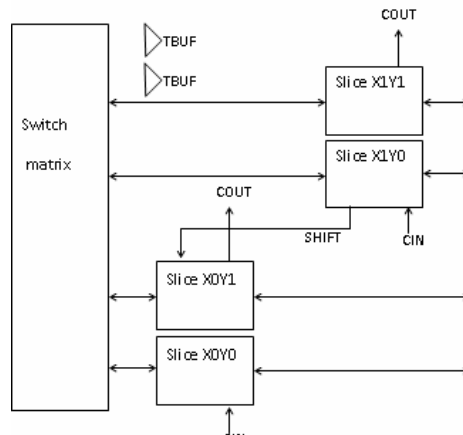


Figure 4. Structure of Configurable logic blocs.

THE IMPLEMENTATION OF HAMMING CODE

The hamming code, on the reconfigurable structures, can be implemented through three possibilities. First is a description of type data flow, the second implementation is with finite state machine (FSM) and third by a full behavioral description. Using first type of description, hamming code module would be implemented full concurrent and it makes sense only if the dates of entry are supplied in parallel form. This description would involve only combinational subcomponents.

If the data are taken in series strings, can be achieved sequential synchronous circuits. In this case is use second and third method. By finite state machine description, is one of the most used to achieve implementation of hamming code. This has the facility to interpret step by step hamming code. However has disadvantage that occupies much area of a FPGA structure which is not convenient when is needed the implementation on a low cost simple FPGA structure.

The black box of module which was implemented is done in follow figure:

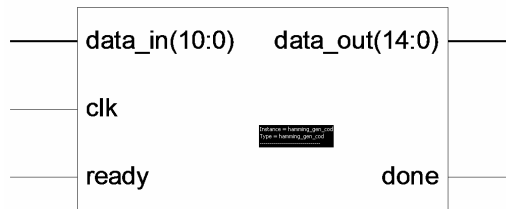


Figure 5. Black box of hamming code module.

The synchronization of hamming module is carried after the *clk* signal. The signals *ready* and *done* are used for handshaking with another. The input ports *data_in*, i.e output data *data_out* are a single bit, the circuit being placed in a serial communication. For example, at (15,5) Hamming code, when appear a rising edge on *ready* port, the module begin counter with third bit because the first and the second are the check parity bits. After 15 bits, serial transmitted, the circuit gives a strobe on *data_out* port. Diagram signals are as follows:

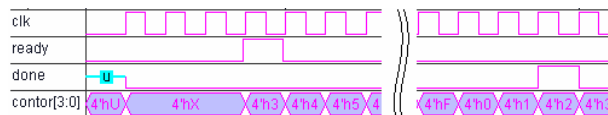


Figure 6. Signal diagram of hamming module.

Internally, the hamming module contains 30 cells of memory that represents 30 bits. Practically may was two string of every 15 bits. He used these two string in parallel, one for loading data and check parity bits computing and the second for data transmission check parity bits (figure 7). The decode hamming module is use the same principle. Physically, when received data series, is calculated on the parallel ones 5 bits par. When it sent the last bit, the check parity bits are placed in a string on appropriate positions. A date string format is transmitted but at the same time the string which had been sent now is filled with a new string of serial data entry.

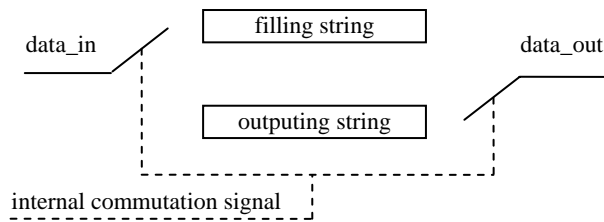


Figure 7. Commutation of internal strings.

Hamming algorithm code has been described in VHDL language. The source code is organized on 5 modules. They are used, for synchronization of input signals, check parity bits, switching strings and sending data.

PERFORMANCE AND EXPERIMENTAL RESULTS

Hamming code module was implemented on a structure FPGA, type SPARTAN 3. Its performance for a (15,5) hamming code is:

Minimum period: 5.778ns (Max. Freq.: 173.070MHz)
Minimum input arrival time before clock: 6.099ns
Maximum output required time after clock: 7.165ns

The area consumed of FPGA is done bellow:

| | | |
|-----------------------------|----------------|-----|
| Number of Slices: | 46 out of 3584 | 1% |
| Number of Slice Flip Flops: | 58 out of 7168 | 0% |
| Number of 4 input LUTs: | 51 out of 7168 | 0% |
| Number of GCLKs: | 1 out of 8 | 12% |

CONCLUSIONS

Hamming codes are used on channels as little as it would be with noisy as memories, lines of high-speed communications. These codes were implementing hardware relatively simple allowing communications systems FEC high-speed but with a correction is their relatively small. Even if they were discovered newer other methods, they still remain actually and hardware implementation is best suited for least noisy high-speed channels of communications.

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PUSHOVER ANALYSIS FOR BUILDING STRUCTURES

Cătălin BACIU¹

¹ Cătălin BACIU, assistant engineer, Military Technical Academy, Bucharest

Abstract: Nowadays the winning formula in building design is to find a convenient way to make a safety structure, able to sustain static and dynamic loads, but in the same time with low costs of production. Both the chosen structural system and the material characteristics offer multiple possibilities to solve even the most difficult building design problems.

The analysis for reinforced concrete structures in the elasto-plastic domain, without reaching the final stage, has to take into consideration the gradual development of plastic deformations. The static post-elastic analysis gives the opportunity to determine the existing reserve capacity of the structural elements. Thus, this type of analysis refers to the check problem.

The static post-elastic analysis consists of "step by step" procedures ("biographical" methods), which are able to show the progressive evolution of plastic deformations.

The main idea of this approach is to determine deformations and stresses of the structural elements, gradually loaded, showing the change of the stiffness due the gradually appearance of plastic hinges.

Keywords: frame, damp, stiffness, plastic hinges, yield, total failure

1. THEORETICAL APPROACH

Static post-elastic analysis is suitable for structures under high intensity seismic loads, where the development of the post-elastic displacements is accepted in the structural design.

First of all, it is necessary to explain the differences between elastic, post-elastic and non-linear analysis:

- *elastic behaviour*: there are no remnant displacements after the structure was unloaded;
- *non-linear behaviour* refers to non-linear connection between forces and displacements. The causes for non-linearity could be physical or geometrical.

Physical non-linearity results from the constitutive laws. It could be elastic non-linearity (the force-displacement curve is the same whether the structure is loaded or unloaded) and post-elastic non-linearity (considerable displacements remain after the loads cancellation). Geometrical non-linearity refers to the development of major displacements. In this case, the balance of the element or of the entire structure has to be considered in the deformed position.

Static post-elastic analysis is a typical check method and allows us to determine the strength capacity of a structure. The main idea of the static post-elastic analysis is to determine deformations and stresses of the structural elements, gradually loaded, showing the change of the stiffness due the gradually appearance of plastic hinges.

The loads, which monotonously vary, gradually generating plastic deformations, could be a growing force system or an imposed displacements system. In addition, a constant load system can be also taking into consideration.

An example for static post-elastic analysis is a frame structure (figure 3), under permanent constant loads $\{G\}$ and horizontal forces $\{H\}$, which are proportionally increased with the load factor λ : $\{H\} = \lambda\{H_0\}$, ($\{H_0\}$ is the base value of the load vector). The forces are indicated by vectors (column matrix), their components being the forces value.

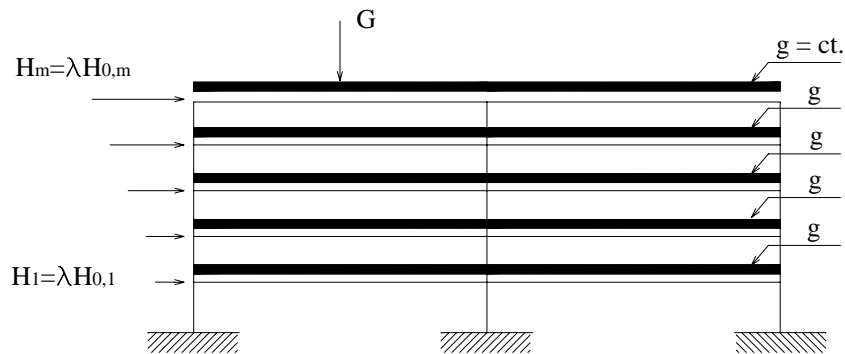


Figure 1 – A frame structure loaded with permanent vertical forces and horizontal forces which proportionally increase

Input data:

- geometry structure;
- dimensions of concrete cross section and rods area for every critical spot; thus, the bending capacities of critical sections (capable moments), positive and negative, according to the stretch fibre, are known:

$$\{M_{cap}\} = M_{cap,i}$$

- constant gravitational loads system $\{G\}$ and the base value of the variable loads $\{H_0\}$.

Request:

- the final values of the variable loads $\{H_u\} = \lambda_u \{H_0\}$ and the final value of λ parameter, according to the last stage (collapse) of the structure.

The procedure, detailed below, uses the assumption that the plastic deformations are developed into plastic hinges, located in critical cross-sections. In these sections, the bending moments reaches M_{cap} value.

The calculus stages are:

1. Static analysis is carried out using gravitational loads; thus, the stresses in critical section are determined (e.g. bending moment, M_g);
2. Static analysis is carried out using the base values of the variable loads H_0 , resulting the bending moment M_{H_i} ;
3. The capable moment in every critical section are determined according to sectional characteristic (geometry, rods percentage) and to the value of the axial force $N_{G,i} + N_{H,i}$.

4. It is determined the ratio $\gamma_i = \frac{M_{H,i}}{M_{cap} - M_{g,i}}$, $i = 1 \dots n$.

The γ_i coefficients represent the ratio between the moments generated by the variable loads and the strength reserve of the section. The strength reserve is determined using the capable moment M_{cap} minus or plus the moment gave by the permanent loads, M_{G_i} . The first cross-section, which starts to yield, is the section with maximum value for γ_i .

5. The maximum value of the γ_i ratio is: $\text{Max}(\gamma_i) = \gamma_k$.
6. It is now determine the value of the H (1) load, which produces a plastic hinge:

$$H^{(1)} = \frac{1}{\gamma_k} \cdot \{H_0\} = \lambda^{(1)} \{H_0\}, \quad \lambda^{(1)} = \frac{1}{\gamma_k}$$

7. In the structural system, an articulation is introduced in “k” section. Thus, the stiffness matrix of the element, which contains the articulation, is modified and, consequently, a new stiffness matrix is generated for the structure.
8. Return to the second step of the procedure, with this new stiffness matrix.

The cycle between steps no. 2 and no. 8 is reiterated, until the number of articulation transforms the structure into a mechanism. The stiffness matrix of the mechanism structure becomes singular (it cannot be inverted anymore).

The quantitative global answer of the structure loaded with external variable forces $\{H\}$ could be visualized using $H - \Delta$ diagram, where: $H = \sum H_i$ is the total horizontal force (variable) and Δ is the horizontal displacement of the last level points.

The static post-elastic analysis, using the plastic articulations assumption, is assimilated with successive elastic analysis, having the articulations placed in the section that gradually yield.

1.1 The assessment of the structural strength capacity

To evaluate the strength capacity of a structure, it is adequate to establish its response to the specific emplacement earthquake.

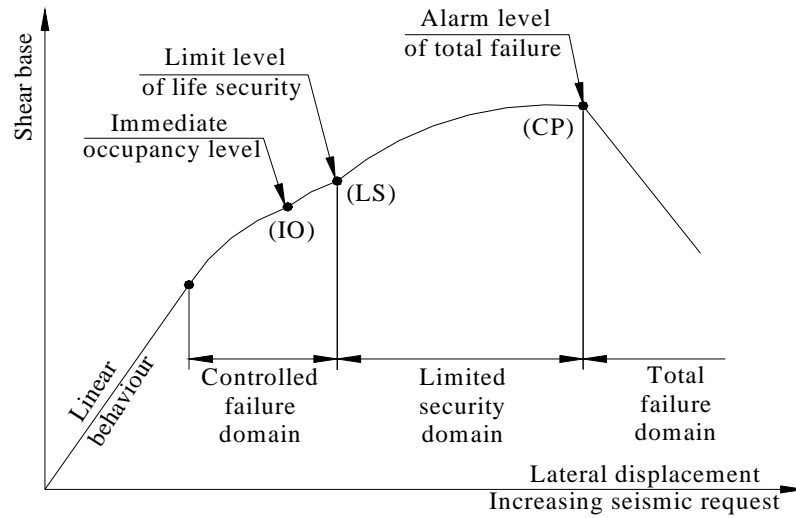


Figure 2 – The performance curve for a frame structure

The seismic response shown in *figure 2*, represents a proportional relation between the lateral forces induced by an earthquake and result lateral displacement. The incipient response of a low seismic excitation is typically elastic linear, but the subsequent one becomes non-linear. The non-linear domain is wider than the linear one, as the structure is more ductile. The area between the graph and the horizontal axis represents the energetic absorption capacity of the structure, thus, the higher structural ductility, the bigger ability for the building to resist to severe earthquakes.

1.2. Capacity – request diagram

After the local proprieties were determined, the global analysis of the structure offers the possibility to calculate the shear force according to the top point displacement. This analysis is applied as a post-calculus.

Firstly, the structure is loaded with seismic forces of first vibration mode. Every force is incrementally increased until the first yield. The yielded element becomes “soft” and the loads are increased until the next element yield. This process continues until a failure mechanism takes form. The “softening” means actually the changing of the stiffness matrix (the constraint becomes joint).

The super-capacity curve ($S_{base} - \Delta_{top}$) could be converted into (SA-SD) spectrum and drawn on the same graph of a response spectrum (*figure 3*).

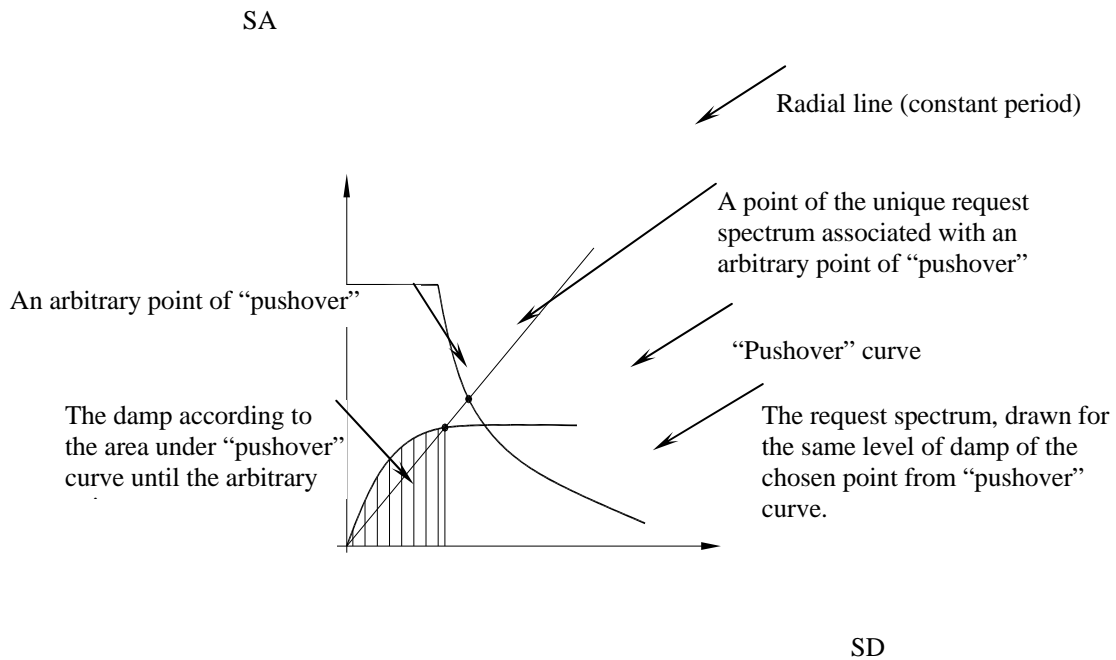


Figure 3 – The portant capacity spectrum

For different levels of damp, it could be drawn requested curves in order to show the energy-waste characteristic of inelastic behaviour.

2. PRACTICAL APPROACH

In order to sustain the theoretical approach, detailed above, this paper also presents an analysed model (a reinforced concrete frame structure).

The model was analysed using an automatic calculus soft “SAP 2000”. There were a few difficulties in order to explain the results, because this soft is based on American standards: ATC 40 and FEMA 273.

Input data

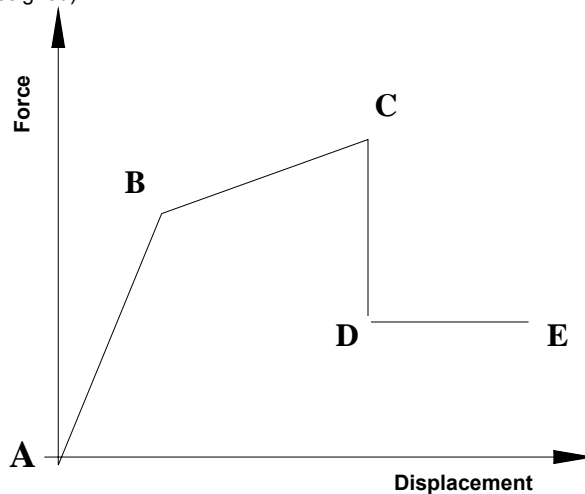
The structure, which was chosen to be analysed in non-linear domain, is a reinforced concrete frame structure, located in Bucharest:

- story height: ground floor - $H_g=3,5m$; first floor - $H_f=3m$;
- bays: 2 (8m) x 3 (6m);
- reinforced concrete element dimensions:
 - columns: 45 x 60;
 - contour longitudinal beam: 25x50 cm;
 - central longitudinal beam: 25x55 cm;
 - contour transversal beam: 30x60 cm;
 - central transversal beam: 30x65 cm.
- loads (uniformed loads on the beams)
 - self-weigh;
 - live: 200 daN/mp;
 - snow (C zone, according to CR 1-1-3-2005);
 - seismic (C zone, $a_g=0,24g$; $T_c=1,6s$ according to P100-2004).

Results

On the base structure, it can be noticed step by step a wide range of data, that result after the structure is analysed:

- displacements (after a certain number of steps, plastic articulations occur);
- stresses: N, T, M (after a certain number of steps, in the same time with plastic articulations apparition, the stresses are reassigned).



Note: Taking into consideration the step by step evolution of the structure, it can be noticed that the magnitude of the deformations can increase or decrease for many times.

The explanation for this phenomenon: when an articulation reaches C point on the force – displacement curve, the value of the force instantaneously decrease to point D. The reduction of the force unloads the elements and consequently the displacement is reduced. Once D point is reached, the base shear force starts to increase again, so the displacement increases again.

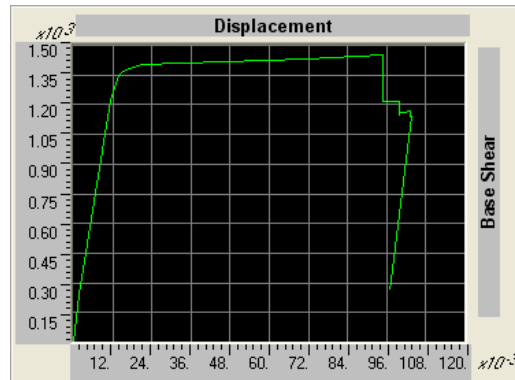


Figure 5 – Force - displacement diagram

After the “pushover” analysis, the computer program offers the possibility to show the base shear - displacement diagram, as well, the capacity curve of the structure. In that diagram (*figure 4*), it can be easily noticed the behaviour of the structure for different values of the equivalent forces, which gradually increase.

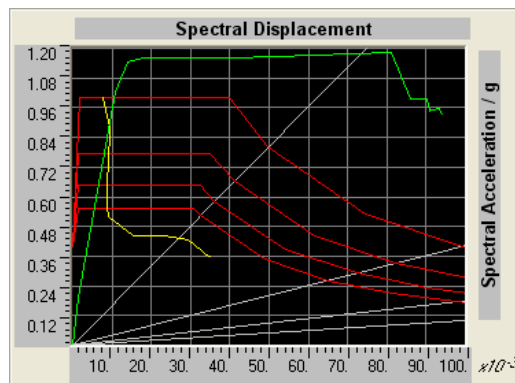


Figure 6 – Spectrum displacement / spectrum acceleration diagram

When a plastic articulation is formed, a new jump of the force value takes place in the graph (*figure 5*). According to the structure type, to the geometrical configuration, to the element dimensions, and to the number of the saved steps, the diagram can have more or less jump values.

The “pushover” curve take shape of the “Acceleration – displacement answer spectrum” (ADAS). In the computer program, the “pushover” curve is converted in ADAS using the conversion of the resulted base shear into a spectrum of acceleration (SA), and the displacement into a spectrum of displacement (SD) (*figure 6*).

3. FINAL CONCLUSIONS

Although the chosen structure is a theoretical one, the paperwork reveals all the stages of a post-elastic analysis

and also the results of the simulation sustain the theoretical considerations presented in the first part of the paper.

According to the type of the structure, to the quality of the material, to the dimensions of the reinforced concrete elements, to the exterior loads values (especially the dynamic loads), it can be obtained more or less steps on the “pushover” curve, more or less jump values on the capacity diagram of the structure.

The computer program allows an easy modification of the input data, offering the possibility to analyse in post-elastic domain a wide range of structural types, in a short period of time.

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AIS MONITORING SYSTEM

Nicolae BADARA¹

Aurelian Traian TUDOR²

¹Dr. ing. Șef lucrări Mircea the Batran Naval Academy

²Șef Lucrari Mircea the Batran Naval Academy

Abstract: *System monitoring / alarm port aims interactive viewing a series of command and control consoles geographical distribution of marine activity reported by AIS system messages in a local or global area.*

The aim is to enhance: safety of life at sea, safety and efficiency of navigation, marine environmental protection, prevention of human and material losses through early alert to local bodies. Achieving this goal is possible only through on-line monitoring and rigorous management.

Key-words: AIS, System monitoring, geographical distribution

System monitoring / alarm port aims interactive viewing a series of command and control consoles geographical distribution of marine activity reported by AIS system messages in a local or global area. The product consists of software called Beacon accompanied console required for the downstream AIS AIS receiver.

Beacon Console has the following features:

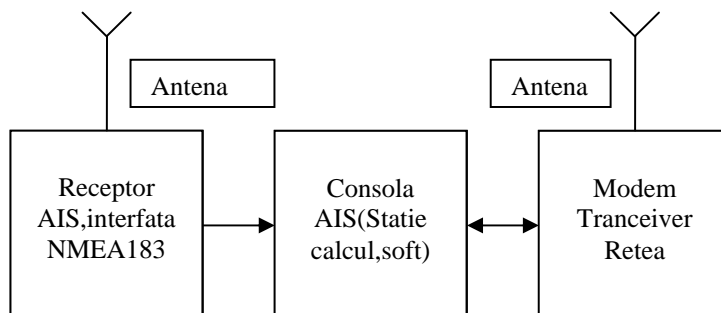
- display maps in various formats in geographical coordinates;
- it connects to the Internet and automatically load specific location maps or high resolution images satelitarecu;
- the coupling to the AIS receiver and display the naval situation;
- AIS-receives and displays information from any point on the globe where there is a console coupled to the Internet and the Beacon dispunde the AIS receiver;

- enable online interaction of several players through messages and bookmarks Beacon consoles on the map;
- allow the real time interaction of intervention activities in emergency situations;
- enable the establishment of zones of alarm that is prohibited movement of ships;
- display consoles Beacon position are coupled to a GPS receiver including where mobile units;
- allows a server to save the persistence of all events and actions recorded by a series of consoles Beacon;
- enables the display of predefined sets of symbols and associating descriptive text;
- runs on a PC or laptop with operating system Windows XP or Vista.

The aim is to enhance: safety of life at sea, safety and efficiency of navigation, marine environmental protection, prevention of human and material losses through early alert to local bodies. Achieving this goal is possible only through on-line monitoring and rigorous management.

Monitoring System includes two components, one sea and one land. Maritime component is mandatory for all ships, not the subject of this project is called tranceiverAIS operates on two VHF channels (161.975 MHz, 162.025 MHz), organized as an S-TDMA channel

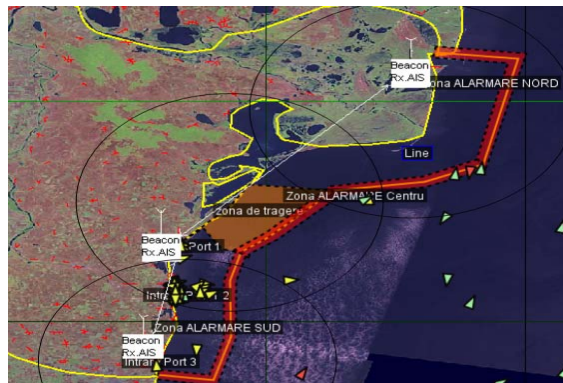
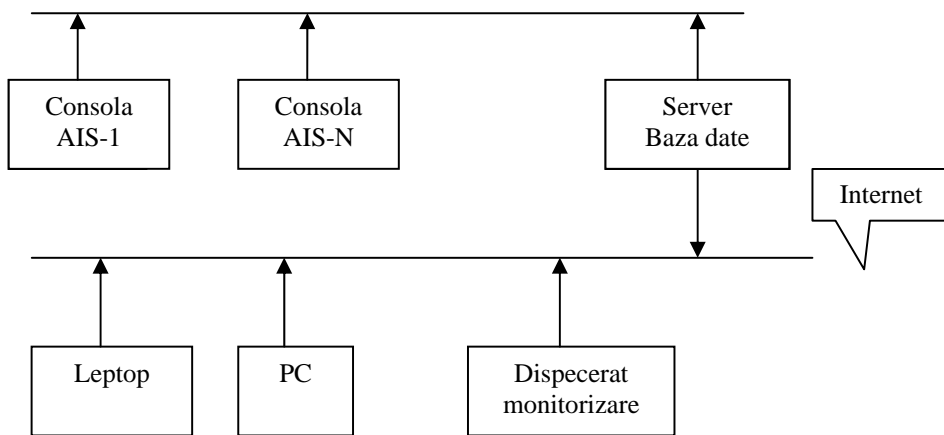
Land component consists of console AIS AIS receiver antenna system, TRANCEIVER modem to connect to the network.



ISA Console consists of computer workstation and software with features urmatoaele;

- display maps in various formats in geographical coordinates;
- it connects to the Internet and automatically load specific location maps or high resolution images satelitarecu;
- the coupling to the AIS receiver and display the naval situation;
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- runs on a PC or laptop with operating system Windows XP or Vista.

The receiver consists dtn AIS receiver NMEA 0183 interface. Modem and network interface is versatile and can be for a GSM network, Zapp own radio network, or wireless.



References:

- [1] Manual for use by Maritime Mobil and Maritime Mobil Satellite Services
- [2] Navtex Manual

THE EFFECTS OF COPPER AS ALLOYING ELEMENT IN ALUMINIUM ALLOYS ON MECHANICAL PROPERTIES

Alin BĂEȚAN¹
Ion SPOREA²
Adriana TOKAR³

¹ Drd. Băețan Alin ,Politehnica University Timișoara

² Prof.dr.eng. Sporea Ion ,Politehnica University Timișoara

³ Prof.dr.eng. Sporea Ion ,Politehnica University Timișoara

Abstract Widespread use of alloy type silumin casting pistons in the engine heat, due to favourable properties of casting (especially flow), requires the use of chemical compositions to provide mechanical resistance as long task, that is to be refractory temperatures above 300°C. The paper is studying two alloys between chemical compositions: Si = 4,5-7,25 and Cu=2,0-4,2 Al rest, who were cast in temporary forms, shell and pressure. Tests performed on the two alloys shows that the higher content of Si and Cu, to obtain superior mechanical properties due to the supersaturate degree of solid solution and the quantity, shape and distribution of silica particles.

Keywords aluminum alloys, casting, mechanical proprieties, aging

1. Introduction

Technological properties particularly suited (high fluidity, lack of hot cracks, low specific weight, can improve the mechanical properties by alloying and structure modification good resistance to corrosion in many aggressive medium etc.) which they possess alloys of aluminium alloyed with silicon, led to employment in the first place regarding the nomenclature and weight (mass) cast forms these alloys. The silumin using in the various fields was much relieved and the fact that these alloys are casting very well in permanents forms between the casting pressures occupies first place [1].

With all the advantages which they present, silumin can not be used in casting parts which are mechanically applied to high temperature, idle are less refractory and sometimes at no mould castings that require high quality of surfaces processed mechanic because this primary silicon (Si_i) and a coarsely eutectic structure conducive to getting processed surfaces occur

2. Alloys material structures

In cupreous silumin alloys are 3 groups of alloys:(1)Ternary alloys used in the construction aggregates ATSi₄Cu₃, ATSi₇Cu₄, etc.(2)Multi-components alloys with different destinations: body pumps, Injun engine heat air-cooled, carter automotive, etc. (ATSi₅Cu₃MgMn, ATSi₉Cu₂MgB, ATSi₅CuMg, ATSi₉Cu₃MgBTi, ATSi₅Cu₇MgMnFe, etc).(3)Alloys for pistons intended primarily for casting pistons for automobiles and tractors (ATSi₁₂Cu₂MgNi, ATSi₂₁Cu₂MgNi).Ternary alloys of the system Al-Si-Cu have good casting properties (high fluidity, low linear contraction, tightly high, high-strength to formation of heat casting cracks. The most common chemical compositions are: for ATSi₅Cu₂ (4,5-6,0%Si + 2-3%Cu) and for ATSi₇Cu₄ (6,75-7,25%Si + 3,8-4,2%Cu). Mechanical properties of the alloys are presented in Figure 1.

These alloys allow as impurity iron: 1,1-1,6% in first case and 0,25-0,5% in the second case; decreased content if casting in AFT, and the highest for casting in chills or pressure casting. Therefore, with the increase of v_r at casting it can be a highest quantity of Fe.

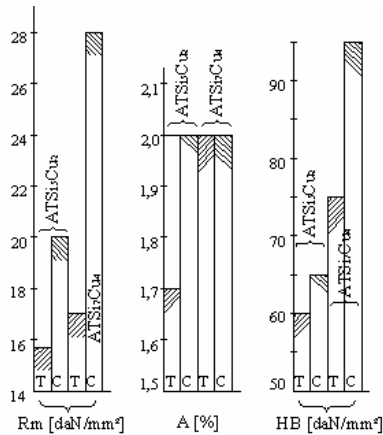


Fig.1 Mechanical properties of the alloys determined on two samples separately cast in AFT: C casting condition; T hardening status

We noted that a solid solution of these alloys is poor in copper. ATSi₇Cu₄ alloy, possesses high mechanical properties (the average content of Ea), properties (Rm and A) which are reduced with increasing the upper limit of the Si and Fe content. This can be explained by the fact that, according to data from Figures 2 and 3, in the Al-Si-Cu system, copper up to 5% can be (depending on many factors as v_r at crystallization, heat treatment applied and to variables conditions, temperatures, speeds, etc). Therefore, in a solid solution, after hardening and aging the ATSi₇Cu₄ will strong strengthen.

However, in this case, the content of Si will find in the alloy to upper limit, and then his coarse structure will reduce the strong effect of heat treatment (solutions hardening and ageing). Therefore to obtain a highest mechanical properties the quantities of Cu and Fe must be happen in the alloy at the lower limit, and the content of Cu in the upper limit (Si < 7%, Fe < 0,25% and Cu > 4,2%).

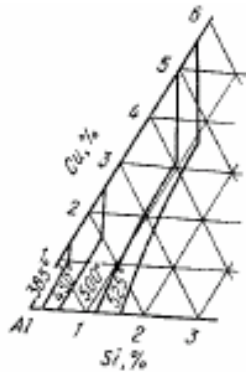


Fig.2 Solubility of Si and Cu in the Al solid

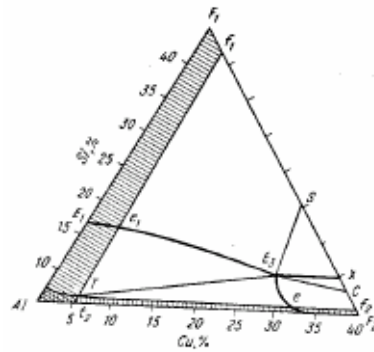


Fig.3 Aluminium angle of state diagram Al-Si-Cu

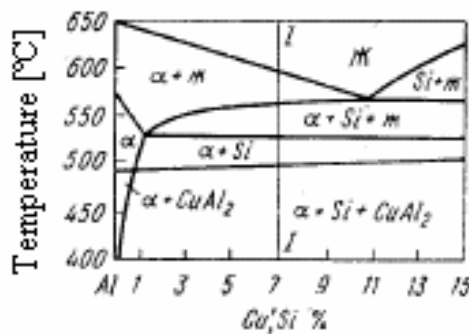


Fig.4 Vertical section of the ternary diagram Al-Si-Cu (Cu content = 4%)

Chemical composition and a phase component of the alloys $ATSi_5Cu_{2.5}$ and $ATSi_7Cu_4$ are very close, and therefore the indices of refractory may not be much differentiate. The differences of refractory that exists between these two alloys can be explained by the quantity, shape and distribution of Si particles, and the degree of supersaturate of α solid solution. In Figure 4 is played the vertical section of the system Al-Si-Cu when the Cu content = 4%.

In this section $ATSi_7Cu_4$ alloy give by ordinate I-I, to be seen that the alloy begin to crystallized (at $T = ct$) at approximately $595^\circ C$ with the separation of primary crystals of α solid solution pre-eutectic of Cu and Si in Al. At the $\sim 570^\circ C$ occurs the crystallization of binary eutectic ($E = \alpha_E + Si_E$). The crystallization of this alloy out of balance conditions at casting (especially in metal forms, molds or under pressure) ends at $525^\circ C$, meaning, at formation temperature of ternary eutectic ($E_1 = \alpha_E + Si_E + CuAl_{2E}$).

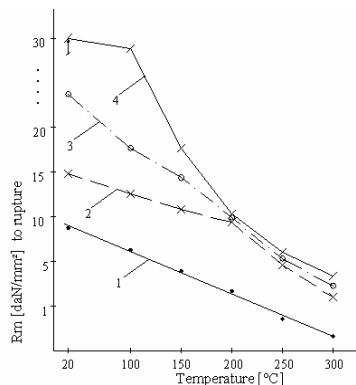


Fig.5 Resistance duration at 100h depending on the chemical composition, temperature and the alloy status: 1- $ATSi_5$ (cast, without copper); 2- $ATSi_5Cu_{2.5}$ (cast); 3- $ATSi_5Cu_{2.5}$ (processed by the T6) and 4- $ATSi_7Cu_4$ (processed by the T4)

Corresponding vertical section from the Al-Si-Cu (Figure 4), $ATSi_7Cu_4$ alloy may strengthen to a sufficient degree by heat treatment. At hardening appears supersaturated α solid solution, of Cu and Si in Al, so at the aging leads to the formation of a heterogeneous structure α solid solution, which requires obtaining a high resistant of the alloys cast in a shell (cooled rapidly at solidification [2]). The resistance of the identical sample but cast in FAF results with 20% lower.

Fig. 2 and 3 shows that $ATSi_5Cu_2$ alloy, crystallize practically analogous as $ATSi_7Cu_4$ alloy, so hardening regimes and aging that applies to $ATSi_7Cu_4$ can be applied to $ATSi_5Cu_{2.5}$ as well.

The difference consists only in a highest temperature ($620^\circ C$) at the beginning of the alloy crystallization resistance $ATSi_5Cu_{2.5}$ alloy. Yet resistance of $ATSi_5Cu_{2.5}$ alloy in hardening + tempering states will be lower, because the degree of super-

saturate of the α solid solution that his owns is lower, so crystalline network of his matrix is less hence, to $ATSi_7Cu_4$ alloy. The purpose of copper in increasing of refractory is shown in Figures 4, 5 and 6.

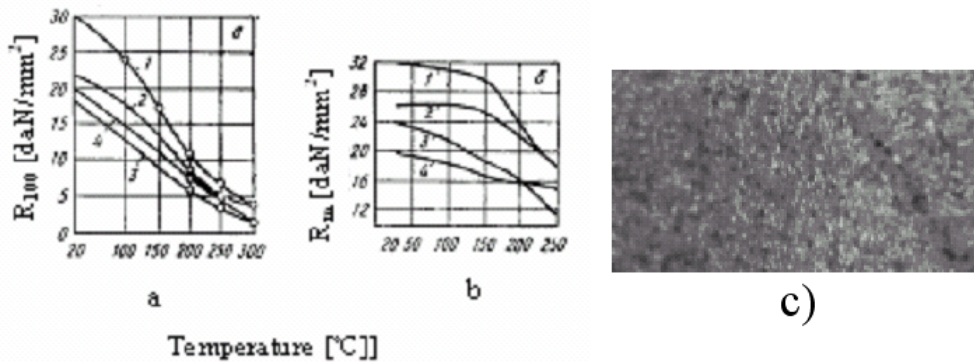


Fig.6 The length dependent resistance (100h) – Rm: a - Si, b –a various alloys: 1- $ATSi_7Cu_4$; 2- $ATSi_5CuMg$; 3- $ATCu_5MnTi$ and 4- $ATSi_{10}MgMn$ c) Structure of $ATSi_7Cu_4$ (scale10000:1)

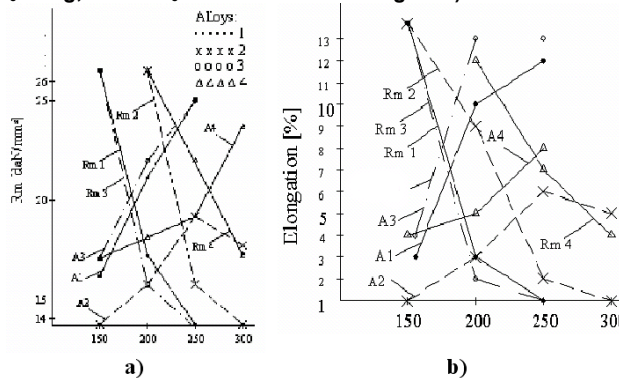


Fig. 7 Mechanical properties at 20 ° C depending on the status and temperature testing: a- after maintain the alloy at 100h; b- after maintain the alloy at 500h

In Figure 7, giving the mechanical properties obtained at 20°C of cast samples in the shell, of various alloys of the type (group) Al-Si-Cu, after having been maintained (mixed) for 100 and 500h at different temperatures.

3. Conclusions

Based on this data it can be concluded:

1. All alloys to maintain the temperature of homogenization for 100h, lose substantial their mechanical resistance and almost totally at 300°C; 2. Once with temperature increase, the silumin alloys with no copper ($ATSi_{10}MgMn$, $ATSi_7Mg$) lose their mechanical strength much more quickly compared to alloys with copper contain ($ATSi_5CuMg$, $ATSi_7Cu_4$). Analysis of data presented in Figure 7 allows you to draw another conclusion:

1. The silumin alloys containing no Cu should not be used for castings (PT) who work a long time (under pressure) at temperatures above 200°C, and the alloys containing Cu and no temperature above 250°C; 2. Refractory of the quaternary alloys form $ATSi_5CuMg$ (and even more complex) is highest. In this case should be stressed that refractory of the $ATSi_5CuMg$, and resistance at room temperature, depends very much on the content of Ea, especially the inclusion of iron; 3. The iron leads to increased refractory, but reduce catastrophic plasticity; 4. At the maintaining temperature of 150°C as the time of 100h and 500h, all alloys showed values of $R_m > 28 daN/mm^2$ something higher for alloy 4- $ATSi_7Cu_4$.

Figures 8 and 6.c give us some typical cuprous silumin structures (Cu-containing).

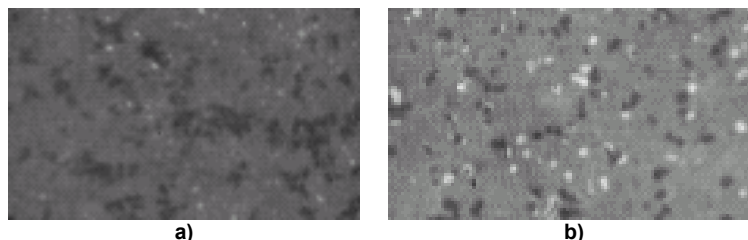


Fig.8 Structure of $ATSi_7Mg$ alloy with 1,4% Cu (20000:1), aging at: a- 165°C / 8h and b- 165°C / 24h.

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EXPERIMENTAL MODELING OF THE LASER WELDING FOR CARBON STEEL USED IN WELDED CONSTRUCTION

Remus BOBOESCU¹
Valentin GLOD²

¹ Drd. Boboescu Remus Politehnica University Timișoara

² Mr. drd. Eng. Glod Valentin Military school “Ereimia Grigorescu” Sibiu, Romania

Abstract *This study presents an experimental study on laser welding of steel Dillimax 500 using a laser with Nd: YAG in continuous regime. Laser power and welding speed are varied on a factorial experimental plan type 2². Weld characteristics are studied. This study presents mathematical models, the hierarchy of influence factors, response surfaces and statistical analysis using ANOVA method.*

Keywords *laser welding, carbon steel, experimental model*

1. Introduction

The laser welding has an important place in the field of laser machining. It is a growing technological field. In industry there is ongoing demand to implement the laser welding technology for new materials. Experimental modeling is a quick solution for knowledge of the welding process. Experimental modeling starts from the consideration of influence factors and wants to predict based on these values for the response functions. The influence factors are process parameters that can be variations (almost) continuously. Response functions are measured or observed values that characterize the process. The link between factors of influence and response functions is done through mathematical relationships called correlation functions or mathematical models (empirical model). To establish the experiment need to determine influence factors, experimental conditions (other factors that will not change) and response functions to be measured. The experimental plan contains values for each factor of influence used in the experimentation. Values for an influence factor influence is also called the factor levels.

Experimental area is the interval between the minimum and maximum value of each influence factor, influence factors being independent variables. Experimental plan should contain a sufficient number of experimentation to determine the coefficients appearing in the expression of correlation function and to allow statistical interpretation of variation in response function. Both functions of correlation and statistical correlation coefficients form the mathematical model. Experimental modeling of laser welding of steels has been the subject of several studies. Olabi (2006)[1] conducted a study on CO₂ laser welding of steels with medium carbon content. As response functions are considered the ratio of weld depth and width and depth of the weld and heat affected zone width. Benyounis and others (2005) [2] studied to optimize the laser welding with a CO₂ laser, of

steel with medium carbon content. As influence factors are considered laser power, welding speed and focal point position, (defocusing distance). As the response functions are heat necessary for the process of welding, weld width, heat affected zone width and depth of weld. Anwara (2008)[3] presented a study on the laser welding of two different materials: steel AISI 316 stainless steel and low carbon steel AISI 1009 using a CO₂ laser with emission in continuous regime. The study led to the conclusion that laser power and welding speed are influence factors of significant influence on the welding bath. Benyounis (2008) [4] is studying the laser welding for stainless steel AISI304. Determined correlation function was the square type. ANOVA method was used for statistical analysis of variance and response surface method for the representation of results. The study described some conditions for the realization of the welding process.

The studies above mentioned consider power and welding speed as influence factors on the laser welding process. There are two categories of response related to the weld, first relates to the weld (depth, width, etc) while the second refers to the whole welding process, particularly at costs.

This work proposes an experimental study on the laser welding process for carbon steel Dillimax 500 EN 10137. A Nd:YAG laser with radiation in continuous regime was used. Influence factors were laser power and welding speed. Response functions were considered related to the weld. Weld width, weld depth and melted area of weld section show the laser capacity to melt the steel. The procedure of experimental design and analysis of results followed the recommendations from [5]. Experimental results were analyzed with the Statgraphics statistical software. It allows simultaneous mathematical model deduction and statistical analysis of variance using ANOVA method. The aim of the work is to help adjusting the process parameters for realize a welded joints with desired characteristics.

2. Experimental Procedure

The material used was steel Dillimax500 EN 10137. This is a fine grain steel with high elasticity limit elasticity. Chemical composition in percent is presented in Table 1. Steel was made by tempering in water and return. Dillimax500 has a low carbon content and relatively low carbon equivalent index. Also it shows a low hardness in heat affected zone and therefore a low risk fracture at cold because inclusion of hydrogen and good tenacity. Experience shows that good characteristics are obtained in welded area if the parameters are chosen so that cooling times $t_{8/5}$ have value between 10 to 30 seconds. In welding process the elasticity limit usually decreases. As a material structure steel Dillimax 500 is relatively homogeneous. Also presents good anticorrosive properties.

Table 1 Chemical composition of steel

| C | Si | Mn | P | S | Cr | Ni | Mo | V+Nb |
|-------|-------|-------|-------|-------|------|-------|-------|-------|
| ≤0.16 | ≤0.50 | ≤1.60 | ≤0.02 | ≤0.01 | ≤0.7 | ≤1.00 | ≤0.60 | ≤0.08 |

The experiment consisted of fusion lines (welds) with the line length of 110mm on steel Dillimax500 plates with 10 mm thickness. An industrial laser machine Nd: YAG Trumpf Haas 3006D was used. It emits radiation with wavelength $\lambda = 1.06 \mu\text{m}$ and have a maximum power of 3kW. Irradiation was performed in continuous regime. Laser beam was transmitted through a fiber with 0.6 mm diameter. The focusing system assures the spot in focal point with 0.6 mm diameter. The focal distance of

lens was 200 mm. As protective gas was argon with a flow rate of 20 l / min. The welds were made on the sheets of material with 100×130×10 mm dimensions. There was a space 20 mm between two consecutive welds.

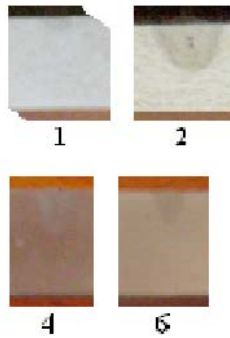


Figure 1 Welds sections associate with table 2

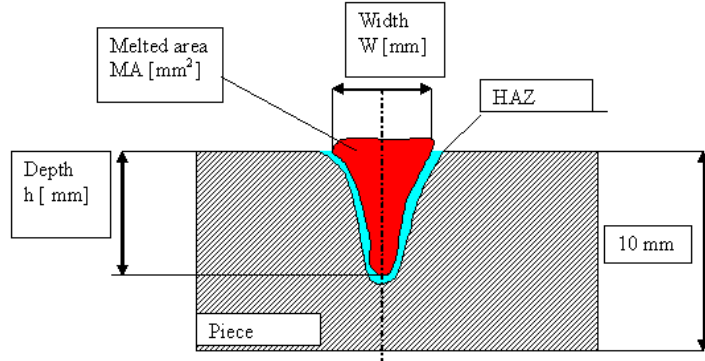


Figure 2 Response functions on the weld section

The radiation was controlled by variation of two parameters: laser power, welding speed. Defocusing distance (position between the focal point and the piece surface) was set at piece surface. After the welding the plates was cut. Cutting of plates was performed at 20 mm before the end of the process, in stabile part of weld, at same distance for all welds.. The piece section has been metallographic processed (polishing and acid attack using Nital) to obtain images of melted metal, heat affected zone (HAZ), and microstructure. On the metallographic processed section were made measurements of the weld width and depth using a microscope to study with accuracy of 0.1 mm. A measured surface area was melted with an accuracy of 1 mm².

3. Method of analysis

The tests performed have followed the plan of a factorial experiment of type 2². This means two influence factors (power P and speed v) with two levels for each, one higher and another lower. The experimental tests are 6. Welds 1-4 correspond for combination of influence factors levels or to the experiment matrix. Welds 5-6 are checks in central point necessary to achieve statistical study. Values for levels of influence factors are presented in Table 2. The interval between the higher and the lower level for each influence factor defined experimental field. In the central point values of influence factors are set at equal distance from higher and lower levels. Statistical analysis is valid for the experimental field.

Table 2 Values for weld parameters (influence factors)

| Weld | Real values | | Coded values | |
|------|--------------|-------------------------|--------------|---------------------|
| | Power P [kW] | Welding speed v [m/min] | Power A [-] | Welding speed B [-] |
| 1 | 1 | 0,6 | -1 | -1 |
| 2 | 3 | 0,6 | +1 | -1 |
| 3 | 1 | 1,5 | -1 | +1 |
| 4 | 3 | 1,5 | +1 | +1 |
| 5 | 2 | 1 | 0 | 0 |
| 6 | 2 | 1 | 0 | 0 |

To study the variation of influence factors and make the hierarchy of them is necessary to consider their values in a coded system. It expresses the normalized values for influence factors. Conversion is based on consideration that for each influence factor is choose the value 1 for higher level and the value -1 for the lower level.

Table 3. Transformation between real and coded values for the influence factors

| Direct transformation | Reverse transformation |
|-------------------------|----------------------------|
| $A = P - 2 [-]$ | $P = A + 2 [kW]$ |
| $B = -2.33 + 2.22v [-]$ | $v = 1.04 + 0.45B [m/min]$ |

Values for the influence factors in the coded system are shown in Table 2. In the coded system laser power was denoted by A and welding speed denoted by B. The transformation between of the real values and coded values for power and speed are presented in table 3. These are linear functions. Transformation between real and coded values for the influence factors.

Response functions analyzed were the weld width W [mm], weld depth h [mm], the ratio F (= W / h) [-] (ratio between weld width and depth) and melted area MA [mm²]. They were analyzed separately using the actual measured or calculate values. The measure system for response function is independent of the system used for influence factors. In future analysis will use both systems of real values and the code values for influence factors. Response functions, except the ratio F, are measured directly. They are represented in figure 2. All response functions studied characterize laser ability to melt the steel.

Mathematical model connecting influence factors with the response function. Mathematical model was considered as a incomplete two degree polynomial. It considers effects of each factor (power and speed) individually and their interaction represented by their product. They are also named the effects and treated as sources of variation to the method ANOVA and

performance charts Pareto. Here are the study of three effects, power, speed and their interaction. The 2^2 factorial consider up to three effects. Polynomial coefficients (regression coefficients) are obtained by solving an algebraic system. Mathematical model was derived using the coded values of influence factors and then using the relations from Table 4 transformed real values of influence factors. Writing the mathematical model for coded system enables the ranking influence factors influence from regression coefficients by observing absolute value and sign. Mathematical model real system has practical utility because can be used directly following units of measurement for each influence factor. Mathematical model is associated with correlation coefficients of R^2 and R^2 (adj. for df) from ANOVA table. Pareto chart provides the hierarchy factors of influence factors. It shows the three effects. Effects beyond dotted line are considered statistically significant. This is associated with a deviation from the average probability P less than 0.05. This is given in Table ANOVA. Interpretation of variation of response function on the basis of Pareto diagrams will be considering that discussed effect will increase.

Method of analysis of variance ANOVA performed for each effect calculation of the partial dispersion due to considerate effect. The ratio between dispersion due effect and total dispersion define value of f (statistical Fisher test). This value will associated with interval probability P around average. It shows the level of confidence in mathematical model obtained.

Response surface shows the variation of response function on the experimental field experimental response. It enables recognition of favorable conditions for the welding process. Mathematic model and ANOVA table containing basic information for the results obtained. Pareto chart and the response surface show the detailed representation of information.

4. Analysis of experimental results

Mathematical model, Pareto chart, ANOVA table and the response surface are discussed for the four response functions.

Weld width W [mm]. Variation of the weld width on experimental field is given by the following mathematical model (1) (2) written in coded values and in the real values of power and speed.

$$w = 2.8833 + 0.55A - 0.55B \tag{1}$$

$$w = 0.5018 + 0.55P - 1.221 v \tag{2}$$

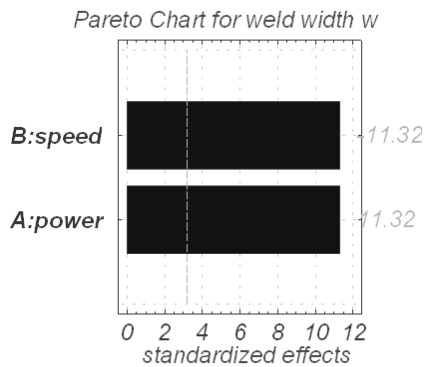


Figure 3 Pareto chart for weld width

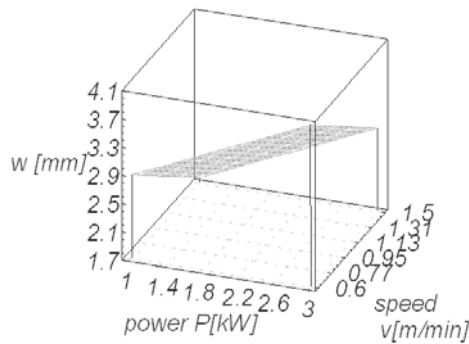


Figure 4 Response surface for weld width

Pareto diagram for the weld width is shown in figure 3. This shows that the power and speed have an equal effect in determining the weld width. The weld width increase with power and it decrease with speed. Power and speed are influence factors with statistical significance while their interaction not has a statistical significance. Table 4 shows the method of analysis of variance for the weld width. It notes the high correlation coefficients for mathematical model.

Table 4 ANOVA table for weld width w

| Effect | Sum of Squares | DF | Mean. Sq. | f-Ratio | P-val |
|---------------|----------------|-------------------------------|-----------|---------|-------|
| A(power) | 1.21 | 1 | 1.21 | 128.12 | 0.00 |
| B(speed) | 1.21 | 1 | 1.21 | 128.12 | 0.00 |
| Total error | 0.028 | 3 | 0.009 | | |
| Total (corr.) | 2.448 | 5 | | | |
| $R^2 = 0.988$ | | R^2 (adj. for d.f.) = 0.980 | | | |

Is desirable to have a weld width as small as possible . Response surface in Figure 4 shows that the minimum weld width on the experimental field is obtain at the highest speed and lowest power

Weld depth [mm] Variation for weld depth on the experimental field is given by the following mathematical (3) (4) model written in coded values and in the real values of power and speed.

$$h = 3 + 1.96A - 0.32B \tag{3}$$

$$h = -1.694775 + 1.9675P - 0.72705v \tag{4}$$

Pareto diagram for weld depth is presenting in Figure 5. Weld depth strong increase with power and decrease to a much lower with speed. The main effect is due to power. Power and speed factors behave as completely independent of effects in relation to the weld depth. Power and speed are factors with statistical significance. Table 5 shows the method of ANOVA study variations. It notes the high values for correlation coefficients.

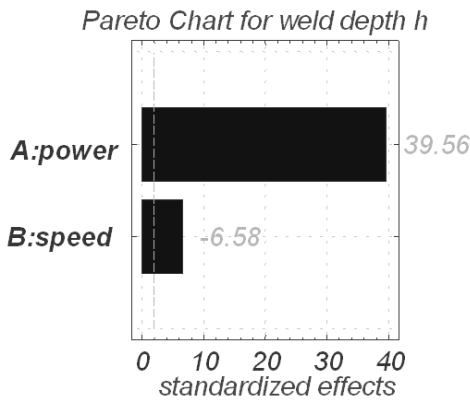


Figure 5 Pareto chart for weld depth

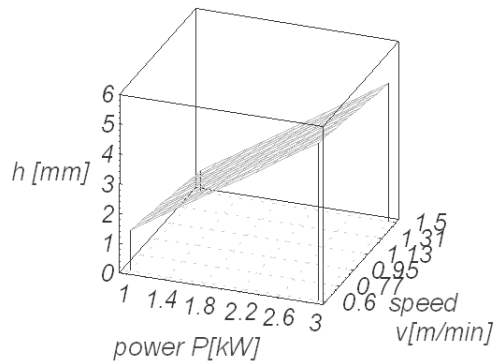


Figure 6 Response surface for weld depth

Table 5 ANOVA table for weld depth h

| Effect | Sum of Squares | DF | Mean. Sq. | f-Ratio | P-val |
|---------------|----------------|----|-------------------------------|---------|-------|
| A(power) | 15.484 | 1 | 15.484 | 1564.94 | 0.00 |
| B(speed) | 0.429 | 1 | 0.429 | 43.36 | 0.00 |
| Total error | 0.029 | 3 | 0.009 | | |
| Total (corr.) | 15.942 | 5 | | | |
| $R^2 = 0.998$ | | | $R^2 (adj. for d.f.) = 0.996$ | | |

In welding is desired a high weld depth as large. Response surface in from Figure 6 shows that the maximum weld depth is obtained at maximum power nearly independent of the welding speed.

Ratio F [-]. F ratio is the ratio of width and depth of the weld. It shows weld shape and has an important role in determining the welding regimes. It is a calculated value. Changes for ratio F on experimental field is given by the following mathematical model (5) (6) written in coded values and in the real values of power and speed.

$$F = 1.535 - 1.025A - 0.375B - 0.425 AB \tag{5}$$

$$F = 4.45875 - 1.025P + 0.8325v \tag{6}$$

Pareto diagram for the ratio F is shown in Figure 7. Pareto chart, shows that ratio F decreases with the power and increasing as halved effect with speed. The power and speed are not statistical significant. Analysis of variation using ANOVA is presented in Table 6. Correlation coefficients have values lower than in previous cases.

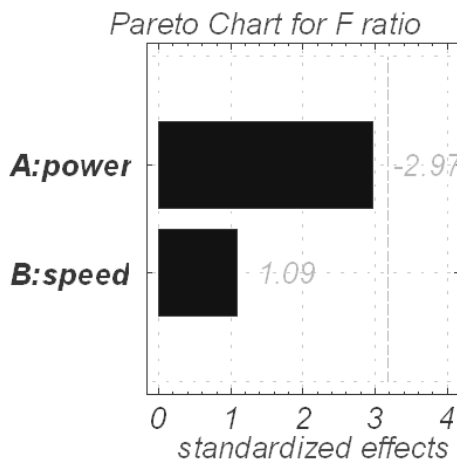


Figure 7. Pareto chart for ratio F

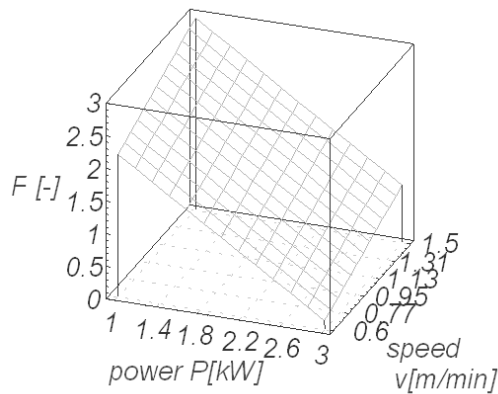


Figure 8. Response surface for ratio F

Table 6 ANOVA table for ratio F (w/h)

| Effect | Sum of Squares | DF | Mean. Sq. | f-Ratio | P-val |
|---------------|----------------|----|-----------|---------|-------|
| A(power) | 4.202 | 1 | 4.202 | 8.81 | 0.05 |
| B(speed) | 0.562 | 1 | 0.562 | 1.18 | 0.35 |
| Total error | 1.431 | 3 | 0.477 | | |
| Total (corr.) | 6.196 | 5 | | | |

| | |
|---------------|-------------------------------|
| $R^2 = 0.768$ | $R^2 (adj. for d.f.) = 0.614$ |
|---------------|-------------------------------|

For F ratio is desired to obtain lower values. The values smaller than unity correspond to a keyhole welding regime. Response surface from Figure 8 shows that the on experimental field the minimum value F is obtained at maximum power and minimum welding speed. From welds made the welds 1 and 3 show a conduction welding regime all other welds show keyhole welding regime.

Melted area MA [mm²] Variation of melted area on experimental field is given by the following mathematical model (7) (8) written in coded values and in real values of power and speed.

$$MA = 3.8666 + 2.7 A - 1.7 B \tag{7}$$

$$MA = -5.4944 + 2.7P - 3.774v \tag{8}$$

Pareto chart for the melted area is shown in Figure 9. It shows that the melted area increases with power and decreasing with the speed (as second effect). Changes in power are significant from a statistical viewpoint. Analysis of variance using ANOVA for melted area is presented in Table 7. Correlation coefficients have high values.

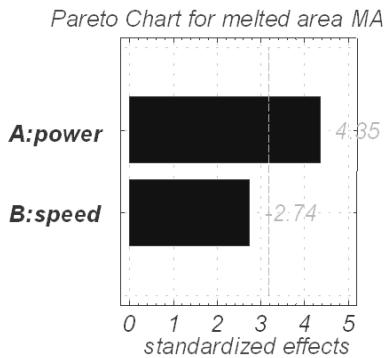


Figure 9 Pareto chart for melted area MA

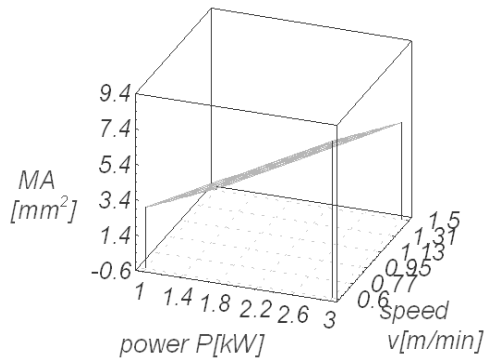


Figure 10 Response surface for melted area MA

Table 7 ANOVA table for melted area MA

| Effect | Sum of Squares | DF | Mean. Sq. | f-Ratio | P-val |
|---------------|----------------|----|------------------------------|---------|-------|
| A(power) | 25.180 | 1 | 25.180 | 16.45 | 0.03 |
| B(speed) | 11.560 | 1 | 11.560 | 7.55 | 0.04 |
| Total error | 4.61 | 3 | 1.53 | | |
| Total (corr.) | 45.333 | 5 | | | |
| $R^2 = 0.89$ | | | $R^2 (adj. for d.f.) = 0.83$ | | |

For melted area is desirable to obtain high values. Response surface from figure 10 shows that the melted area has maximum value on experimental field at maximum value for the maximum power and minimum welding speed.

5. Conclusions

The aim of experimental study was the assessing contribution of power and speed of welding to weld characteristics. From the analysis carried out were the following: power has main effect on all response function and in conclusion for laser melt capacity; power increase laser melting capacity of steel and welding speed decrease this capacity; mathematical models for the weld width and weld depth provided a good statistical correlation and statistical significance. The experimental modeling achieved considered only the main part of the laser processing. There have been lines fusion lines and not welded joints. Were varied only main factors of influence, power and speed, while focal point position in relation with the piece surface and assistant gas parameters was maintaining constant. The plates used were sufficient thick to not be penetrated during welding. It is important that experimental research should be applicable in slightly modified experimental conditions. We will make some recommendation to allow generalization of results. To fill the gap between tow pieces using at laser welding using added material in the form of wire. It is recommended that the melted area MA area to be considerate reduce with wire section. It is recommended that only half of the predicted depth can be associated with a enough large width o melted zone in piece. If the weld is completely penetrated its width increases while prediction of melted area is maintained constant. Mathematical models performed make predictions for the laser welding results for Dillimax 500 steel or other steels with close thermal characteristics. Experimental research methods used are generally applicable in material processing.

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ABOUT BALLAST WATER TREATMENT METHODS

Paul BOCĂNETE¹
Emilian MACĂRIE²
Ionel POPA³
Dinu ATODIRESEI⁴

¹ Professor Ph.D. Eng., Maritime University Constanta

² Eng, Navigable Routs Administration

³ Ph.D. Eng., Naval Academy of Constanta

⁴ Eng., Biolog, Naval Academy of Constanta

Abstract. *This paper examines a promising ballast water treatment technology. Ships need ballast water for their stability and maneuverability. This water is not pure, but it contains a sample of the local ecosystem at the place of intake. Within a few days to weeks, vast quantities of water are shipped from one continent to the other. At the port of destination, ballast water is often pumped overboard, including the organisms it still contains. The receiving ecosystem is not always well adapted to the reception of newly introduced species. Such new species sometimes develop into a plague, pushing native species to the edge of their existence. The International Maritime Organization of the UN has declared that from 2009 onwards ballast water has to be free of organisms to minimize the risk of introduction of invasive species*

Key words: *ballast water treatment; ballast water management; aquatic nuisance species (ANS); non-indigenous species (NIS); tank ship; risk assessment; hazardous area; ship operations. ballast, water, hypochlorination systems, pumping equipment*

1. INTRODUCTION AND BACKGROUND

Worldwide concern for the unintentional migration of nonindigenous species (NIS) by all vessel types is well documented. In 2004, the International Maritime Organization (IMO) adopted the *International Convention for the Control and Management of Ships' Ballast Water and Sediments* (Convention) for the “prevention, reduction, or elimination of the transfer of harmful aquatic organisms and pathogens through the control and management of ships' ballast water and sediments.” Upon ratification of the Convention, vessels that need to discharge while in port must either exchange ballast water at sea or treat ballast water. However, timelines in the Convention and Application Resolution A.1005(25) phase out the acceptance of ballast water exchange, and require the installation of ballast treatment systems on all newly-built and existing vessels that discharge ballast water in port. These ballast treatment systems will need to meet a prescribed performance standard as established by Regulation D-2 of the Convention. Additionally, various national, regional, and local regulatory bodies are establishing requirements for ballast water treatment prior to discharge in local waters. In 2004, the US Coast Guard unveiled the Shipboard Technology Assessment Program (STEP), recognizing the need for ship prototype installations to facilitate the development of effective ballast water treatment technologies. The National Oceanic and Atmospheric Administration (NOAA) has also supported the need for shipboard experience, with the Ballast Water Technology Demonstration Program. Support from such programs, along

with industry investment, has accelerated ballast water treatment research, development, and testing efforts. These efforts include testing of prototype systems on a variety of oceangoing vessels and shore-moored barges. Despite these advances, there has not been sufficient prototype testing of practical systems for tank ships. This paper examines the design and installation of a promising ballast water treatment technology. It includes a review of a risk assessment that demonstrates that the design and installation on a tank ship maintains an equivalent level of safety as other already approved, comparable systems.

2. THERMAL TREATMENT

High temperatures are commonly used to sterilize water. Thermal treatment is a technique that could be used to kill nonindigenous species (NIS) in ballast water by heating the ballast to a high enough temperature to kill NIS before the water is discharged. This method is currently being examined as an on-board treatment option; however, thermal treatment can also be used in an on-shore ballast water treatment facility.

Thermal treatment of ballast water onboard tankers is currently being explored as a viable option for treating ballast water during vessel transit. Options for heating ballast water onboard a vessel include: (fig. 1) use of waste heat produced by the ship's engines and (fig. 2) use of heat created by auxiliary boiler systems installed aboard the vessel. Current research is focused on the use of waste heat produced by ship engines since it may provide the most cost-effective technical solution.

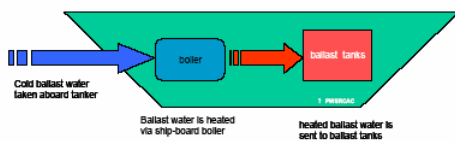


Fig. 1

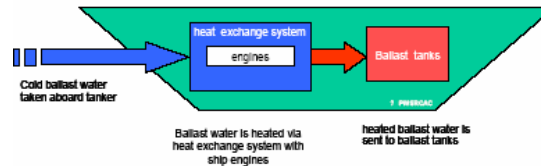


Fig. 2

The diagram to the right illustrates how a heat exchanger can be used aboard a vessel to capture waste engine heat to warm ocean ballast water to temperatures capable of killing NIS. More expensive systems involve installation of additional boilers and fuel tanks specifically designed to heat ballast water while in transit as shown in the simplified schematic to the left. In this situation, additional heating capacity is installed aboard the vessel to heat the ballast water to a higher temperature than can be achieved by scavenging the ship engine's heat using a simple heat exchanger. Additional heating capacity may be required to effectively kill a wider range of NIS in the ballast water.

Installation of an auxiliary boiler system aboard a tanker would include installation of the boiler and a suitable pretreatment filtration system, plumbing modifications, construction of deck shelter to house system if no below-deck location is available, plumbing for a bypass system in the event of a failure, routing of fuel lines and potential installation of an additional fuel tank, and routing of the boiler exhaust to main stack or other exhaust system.

On-board trials have demonstrated that waste engine thermal systems can increase ballast water temperatures to 37-38°C (98- 100°F) and are effective in killing a majority of NIS. Higher temperatures are required to effectively kill all microorganisms including cysts. The length of time ballast water is exposed to target temperatures affects the organism mortality. Longer exposure times result in higher kill rates. Optimal exposure times are species dependent and must be researched and tested for specific applications: however, current research shows typical exposure times to range from under a minute to more than four hours to achieve effective kill rates.

To date, most research on the effectiveness of thermal treatment at different temperatures and incubation periods comes primarily from Australia where several ships were retrofitted with heat exchangers or boiler systems to field test the viability of thermal treatment of ballast water aboard a vessel. Overall, researchers are finding the viability of thermal technology design will vary depending on the ship's heat balance, engine cooling system design, availability of steam, and the additional equipment and degree of retrofit required.

Technology Advantages. Waste heat from the ship's main engine is typically pumped overboard as a waste product. Thermal treatment offers a safe and cost effective method for treating NIS in ballast water, using onboard resources, and recycling waste heat. While many treatment methods are effective in killing water-borne NIS, few are effective at killing NIS embedded in sediment which has accumulated at the bottom of the ballast water tanks. Thermal treatment has the added advantage of heating sediment contained in the ballast water and killing NIS that reside in the sediment. Thermal treatment technology occupies an acceptable onboard footprint and has been demonstrated to effectively kill the majority of organisms in ballast water.

Cost. Thermal treatment costs are not yet fully known and are extremely vessel specific. One of the key cost drivers is what temperature is required to effectively kill the NIS of concern. If the NIS can be treated by the temperature achieved by scavenging ship engine heat, a cost-effective retrofit may be achieved. If higher temperatures are required to treat the NIS, auxiliary boiler systems may be required and will substantially increase the treatment cost.

Retrofits for systems relying on ship engine waste heat would likely require installation of more efficient heat exchangers, piping, pumps, and valves. Boiler installation cost estimates will be vessel specific; however, one study provides a little insight on the range of costs to be expected. Ballast Water Secondary Treatment Technology Review by Battelle Labs¹ estimates costs at \$60K-200K for boiler installation; \$28-45K for plate heat exchangers, and \$88K for recovery heater heat exchanger. Supplemental energy may also be necessary and would require installation.

, viruses and bacteria, withoutumps.

3. U.V. TREATMENT

The method is based on solid separation (filter) as pre-treatment and high doses of UV irradiation for inactivation of marine organisms, viruses and bacteria, without affecting the normal operation of the ship. Ballast water is treated both during ballasting and de-ballasting to ensure the dual effect.

The Ballast System can be fitted in new ships and retrofitted in older ships. The MicroKill Medium Pressure UV can handle almost any flow when multiple reactors are built into a manifold system. The components in the System are flexible; the filter can be installed either horizontally or vertically (fig 3a, 3b). The installation is normally in the pump room or engine room and in close proximity to the ballast pumps.



Fig 3a



Fig 3b

Technology Advantage: High power UV or MicroKill UV or efficient kill or inactivation of organisms, bacteria and pathogens in ballast water, Developed and manufactured for installations aboard ships, Optimized for minimum maintenance and operations UV and temperature sensor on each reactor, Designed and manufactured for marine environment, Voltage 380 to 690V, 50/60 Hz, New development with PLC controls

4. Treatment of Ships Ballast Water and Sediments

Ballast Water Convention that regulates the numbers of viable organisms to be discharged with the ships' ballast water and / or with the sediments from the ballast water tanks. The **SEDNA®-System** operates in-line during the uptake of the ballast water. It is based on a modular concept that includes a two-step physical separation as well as a secondary treatment with an oxidising agent:

-The 1st step of the physical separation is a new developed hydro cyclone that was specifically designed for ballast water applications. It significantly reduces the sediment load of the ballast water. The small size of the individual hydro cyclone allows installation on a single deck. The number of hydro cyclones needed depends on the flow rate of the ballast water pump.

-The 2nd step of the physical separation is a compact, self-cleaning filter with only 50µm meshes. The cleaning of the filter is triggered by the differential pressure (max. 100 mbar), and the filter elements are cleaned one by one with seawater without addition of any cleaning substances. During the back flushing process, the ballast water operation continues at reduced flow rates.

This combination of 2 different physical separation processes guarantees that the treatment plant can handle varying loads of solids in the water – a typical problem in harbour basins – as well as effectively remove a wide range of organisms of different sizes. This combination of physical treatment methods serves two functions:

a. It significantly reduces the sediment load of the ballast water and it removes nearly all organisms greater than 50µm.

b. It increases the stress imposed on the organisms present in the ballast water, resulting in physical damage of the organisms as well as an increased sensitivity towards the secondary treatment. Any concentrates from the hydro cyclones (mainly sediments) and any rejects from the fine filter remain at their point of origin and no new waste lines are produced.

The secondary treatment is a fully biodegradable, chlorine-free disinfection with a oxidising agent (PERACLEAN® Ocean). It does not accumulate in the environment and is safe for both ship and crew. No safety or health risks occur, if the system is operated according to specifications of the manufacturer. The oxidising agent is dosed automatically to the ballast water after the physical treatment. There is no manual handling of the substance required. However, there are general requirements regarding the handling of chemicals with hazardous properties that are outlined in the Material Safety Data Sheet (current MSDS can be obtained directly from the manufacturer). Storage of PERACLEAN® Ocean is required in relation to the ballast water volume that should be treated. The following table gives an overview of the amount of PERACLEAN® Ocean needed to treat different volumes of ballast water at 150ppm.

Treatment prevents the re-growth of organisms in the ballast water tanks. However, the treated water should be retained for a minimum of 24 hours. There are also no limitations according to ballast water capacities or different water qualities. Due to the modular concept, with a two stage physical treatment module for sediment removal and pre-conditioning of organisms, the system can be operated safely even in waters with high sediment loads and / or in dense phytoplankton blooms. The secondary treatment, too, is effective at any salinity and at various temperatures, resulting in maximum efficacy of the **SEDNA®-System** and in complete independence from the water quality. It is suitable for both, retro-fitted installations and installations on new builds.

The **SEDNA®-System** is self-monitoring (SPS controlled) with automated bypass according to class requirements (GL). Any malfunction will trigger an alarm signal in the control room and a detailed description of the malfunction is displayed on a touch-screen with interactive help functions.

Example: see the 3-D-models below of a 200m³/h installation and a 750 m³/h **SEDNA®-System** that have been adjusted to a specific ship (POSTPANMAX container vessel).

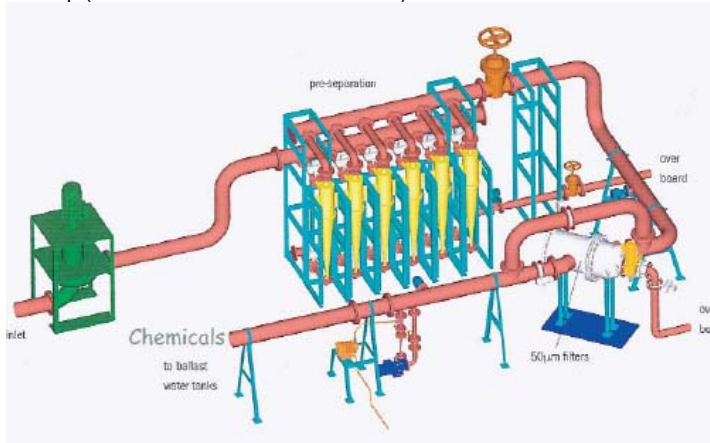


Fig. 4 Installation SEDNA®-System: 3 V6 hydro cyclone modules + 50µm fine-filter + PERACLEAN® Ocean dosing station and day tank.

Test Results (fig 5)

I. Sediment removal efficacy of the **SEDNA®-System** The ability of the **SEDNA®-System** to remove sediments was evaluated in the harbour of Hamburg (Jan. / Feb. 2005; total of 46 tests), which resembles a typical port situation. The particle size of the suspended solids was were small, with a mean particle size of < 4µm. 99% of the particles were < 21 µm, letting them pass a 50µm fine- filter without any difficulty.

The average amount of suspended solids (TSS) varied from 44 mg/l in Jan. 2005 (range 18mg/l to 104 mg/l) to 27 mg/l in Feb. 2005 (range 5 mg/l to 75 mg/l). The results of the tests clearly demonstrated, that the hydro cyclones already removed some 29% of these small particles with the potential to reduce the total amount of sediment in the ballast water tanks dramatically.

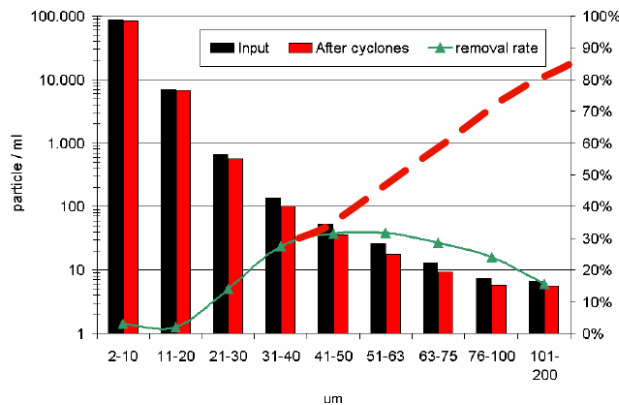


Fig. 5 Particle distribution of suspended solids during tests

II. Biological efficacy of the **SEDNA®**-System The system demonstrated at each of the test locations, that it reached or even exceeded the D2 standard of the IMO Ballast Water Convention for organisms >50µm and organisms between 10µm and 50µm in the smallest body dimension. The test results were completely independent from the water quality. Neither variations in the salinity, nor excessive suspended solids showed any kind of effect on the efficacy of the treatment process. Furthermore, third party tests carried out by the Royal NIOZ Institute (Texel, The Netherlands) showed that no re-growth of algae or bacteria occurred in model ballast water tanks for a period of up to 40 days (bacteria). However, natural bacteria populations showed normal growth, when added to the treated water (priming after 18 days). This clearly demonstrates that there are no environmental risks when the treated water is discharged at the port of call. The results of the biological efficacy tests are summarised below.

5. OZONE TREATMENT OF BALLAST WATER

This method is an invention which relates to a method and apparatus for ballast water in order to eliminate/strongly reduce the ballast water's content of biological organisms, by injecting ozone gas into the ballast water during loading of ballast water (fig 6). The inventive apparatus is sufficiently light, small and cheap such that it can relatively easily be implemented in most existing ships as well as new ship design, and that is able to satisfactorily kill the marine organisms in the ballast water, either as a separate system or in combination with conventional ballast water treatment systems.

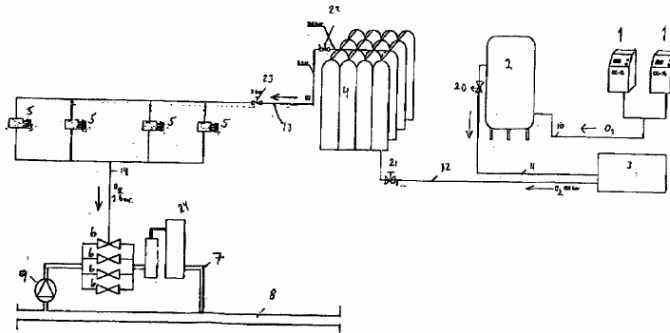


Fig. 6 – oxygen generator; 2 – oxygen storage; 3 – compressor for liquefying the oxygen; 4 – storage for liquid oxygen comprising a battery of transportable gas containers; 5 – ozone generators; 6- venture injector; 7 – by-pas–line; 8 – pipe- line for the ballast water; 9- booster pump for pumping ballast water through pipe 8; 24-contact vessel, for disposal of excess ozone and/or providing increasing reaction-time, is located after venture injector

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CALCULATION OF CONSTRUCTION PARAMETERS INDUCTION MOTORS WITH BILATERAL ARC INDUCTOR, RADIAL AIR GAP AND NOZZLE INDUCED

Teodor BUGLEA¹

¹ Lt.cdor.(R) drd.ing., officer in charge of a navigational watch – on ships of 500 GRT or more

Abstract. The paper presents an coherent algorithm for determining account of the constructive parameters of induction motors with bilateral arc inductor, radial air gap and nozzle induced. It was used in making a experimental model used in power plants active government.

Keywords: synchronous speed, nozzle induced, air gap, polar pitch, teeth pitch, equivalent air gap, Carter factor, quality factor of the motor.

For theoretical basis of design induction motors with bilateral arc inductor, radial air gap and nozzle induced, hereinafter MAIABIRID, we developed an algorithm for designing application-specific concrete from geometrical parameters of the plant.

The calculation parameters MAIABIRID builders of runs in the sequence shown below.

1. Synchronous speed.

The design data, speed industrial assembly propeller-nozzle-induced is required for mechanical characteristics of the propeller, and thus avoid the phenomenon of cavitation. Impose a sliding value, can determine the synchronous speed with the relationship:

$$n_1 = \frac{n}{1-s} \quad (1)$$

where:

- n_1 – synchronous speed of inductor field [rpm];
- n – rotational speed (assembly propeller-nozzle-induced) [rpm];
- s – sliding [%].

2. Diameter of nozzle induced.

Construction starts in diameter propeller used in the experimental model. First time, propeller is fixed rigidly in a nozzle with inner diameter equal to the propeller's diameter.

With a flange, the nozzle diameter propeller is increased so that the inner arc inductor is not willing to water flow of the propeller. Otherwise, depending on the assessment scale indoor inductor, through several iterations, it takes inner diameter $D_{i,duza}$ induced nozzle.

Thickness induced nozzle, denoted by g , to ensure good mechanical strength to allow development motion forces without deformation of nozzle, and on the other hand must be selected according to applications such as electrical, heating and losses caused by induced. Depending on the material induced nozzle, is allowed a certain current density J [A/mm²] taking into account section movement induced current in a pole $S = \tau \cdot g$.

In case of with power less than 100kW can take $g = 3$ mm copper and $g = 4$ mm aluminum.

3. The air gap.

Due to mechanical, to accept a higher amount of space between inductor and induced.

It adopts mechanical air gap value $\delta_m = 3 + \delta$ 10 mm.

Given that induction motor is bilateral, air gap value δ is obtained by the relationship:

$$\delta = 2\delta_m + g \quad (2)$$

where:

- δ_m – mechanical air gap, air space between inductor and induced;
- g – thickness induced.

4. Determination of the active radius of the two inductors.

Because the engine is composed of two arc-inductors arranged one inside the nozzle and the other on the outside, it must determine the radius of their working parts.

For the inside inductor the active side represents the side with maximum radius (outer) and the external

inductor, the side with minimum radius (inner). It is calculated as follows:

a) outer radius of the inner inductor:

$$R_{1ie} = R_{2i} - \delta_m \quad (3)$$

b) inner radius of outer inductor:

$$R_{1ei} = R_{1ie} + \delta \quad (4)$$

where:

R_{2i} - induced nozzle inner radius:

$$R_{2i} = \frac{D_{i,duza}}{2} \quad (5)$$

$D_{i,duza}$ - inside diameter of the nozzle induced.

5. Tangential speed of synchronization.

Given that the tangential speed of synchronization v is a function of inductor radius, and the motor is composed of two inductors made of different rays, shows separate values for each inductor in part:

a) for inside inductor:

$$v_{1i} = \frac{2 \cdot \pi \cdot n_1}{60} \cdot R_{1ie} \quad (6)$$

b) for outside inductor:

$$v_{1e} = \frac{2 \cdot \pi \cdot n_1}{60} \cdot R_{1ei} \quad (7)$$

As the need for synchronous speeds are equal to the induced is necessary to determine the tangential speed of synchronization in the middle induced thickness as:

$$v_1 = \frac{2 \cdot \pi \cdot n_1}{60} \cdot \left(R_{2i} + \frac{g}{2} \right) \quad (8)$$

or

$$v_1 = \frac{v_{1i} + v_{1e}}{2} \quad (9)$$

6. The choice of motor's power supplying.

It requires setting the number of phases m and frequency f_1 .

For three-phase system $m = 3$.

7. Determination of polar pitch.

The polar pitch is proportional to the tangential speed of synchronization, different for each inductor separately. Calculate with the relationship:

a) for internal inductor:

$$\tau_i = \frac{v_{1i}}{2f_1} \quad (10)$$

b) for external inductor:

$$\tau_e = \frac{v_{1e}}{2f_1} \quad (11)$$

8. Determining teeth pitch.

Because the teeth pitch is depending by polar pitch it leads to different values for each inductor separately. Use the relationship:

a) for internal inductor:

$$\tau_{di} = \frac{\tau_i}{mq} \quad (12)$$

b) for external inductor:

$$\tau_{de} = \frac{\tau_e}{mq} \quad (13)$$

where q is the number of slots on the pole and phase.

9. Choosing the number of poles.

Given the considerations made in [5], the number of poles affects negative effects of the field pulse, the minimum number of poles recommended [3], [7], the $2p = 4$.

10. Slot's scale preliminary determination.

For both inductors the same size set of slots, so that, for a side of induced nozzle, corresponding to slot by slot, face to face. Is determined, an indication, the relationships:

a) slot's width:

$$\beta = \frac{b_c}{\tau_d} = 0,4 \dots 0,75 \quad (14)$$

b) slot's depth:

$$\beta_1 = \frac{h_c}{b_c} = 2,5 \dots 12 \quad (15)$$

11. Preliminary determination of tooth's width.

Maintaining for both inductors, the same dimensions of slots, in terms of different teeth pitches, will lead to different tooth sizes for the two inductors, thus:

a) for internal inductor:

$$b_{di} = \tau_{di} - b_c \quad (16)$$

b) for external inductor:

$$b_{de} = \tau_{de} - b_c \quad (17)$$

For ends tooth, references [5] recommended a greater width, not less than double the width of a tooth:

$$b_{d0} \geq 2 \cdot b_d \quad (18)$$

12. Inductors preliminary length.

The inductor's length of induction motor with bilateral arc inductor, radial air gap and nozzle induced is suitable ray active area and it is calculated with relations:

a) for internal inductor:

$$L_i = 2 \cdot p \cdot \tau_i - b_{di} + 2 \cdot b_{d0} \quad (19)$$

b) for external inductor:

$$L_e = 2 \cdot p \cdot \tau_e - b_{de} + 2 \cdot b_{d0} \quad (20)$$

13. Inductors preliminary width.

Influence the proportional force developed at starting and studied literature recommended, but not required, the width l is the polar pitch value.

14. Inductor's winding adoption.

Winding chokes adopted for the motor is the ring type of enamelled copper conductor, which allowed a current density $J_{Cu} = 4 \div 7 \text{ A/mm}^2$, under conditions of forced cooling.

References, [1], [2], [3], [4], [6], [7], provides recommendations for limits of variation of the following sizes:

- winding factor, $K_w = 0,91 \div 0,99$;
- field form factor, $K_f = 1 \div 1,1$;
- slot filling factor, $K_u = 0,5 \div 0,65$;
- saturation coefficient, $K_s = 1,01$;
- packing factor, $K_{Fe} = 0,97$.

Recommended maximum values of induction in different parts of the magnetic circuit winding chokes are:

- induction in the yoke, $B_j = 0,77 \div 1,2 \text{ T}$;
- induction in the air gap, $B_\delta = 0,2 \div 0,7 \text{ T}$;
- induction in the teeth, $B_d < 1,7 \text{ T}$.

Iron relative permeability: $\mu_{Fe} = 450 \div 8000$.

15. Surface resistivity of induced.

Calculate the relationship:

$$\rho_s = \frac{\rho_i}{g} \quad (21)$$

where:

ρ_i – volume resistivity;
 g – thickness of induced.

16. Resistivity corrected surface.

Calculate the relationship:

$$\rho_r = K_p \cdot \rho_s \quad (22)$$

where:

$K_p = 1,02$ – coefficient of induced resistively correction.

17. Equivalent air gap calculation.

To determine the equivalent air gap value use the relationship:

$$\delta' = K_\delta \cdot \delta \quad (23)$$

in which:

$$K_\delta = K_{Ci} \cdot K_{Ce} \quad (24)$$

where:

$$K_{Ci} = \frac{\tau_{di}}{\tau_{di} - \gamma \cdot \delta} \quad (25)$$

$$K_{Ce} = \frac{\tau_{de}}{\tau_{de} - \gamma \cdot \delta} \quad (26)$$

is the Carter's factor corresponding to each inductor, in which:

τ_{di} , τ_{de} – teeth pitch of inductor inside that outer;

δ – air gap;

γ – coefficient given by [8]:

$$\gamma = \frac{\left(\frac{b_c}{\delta}\right)^2}{5 + \frac{b_c}{\delta}} \quad (27)$$

18. Reduction of design sizes in the induced level.

For use same sizes design in subsequent calculations we have introduced the following concepts reduced to the induced level:

- polar pitch:

$$\tau = \frac{\tau_i + \tau_e}{2} \quad (28)$$

- teeth pitch:

$$\tau_d = \frac{\tau_{di} + \tau_{de}}{2} \quad (29)$$

- teeth width:

$$b_d = \frac{b_{di} + b_{de}}{2} \quad (30)$$

19. Quality factor of the motor

Relationship quality factor calculation is the format:

$$Q = \frac{2 \cdot f_1 \cdot \mu_0 \cdot \tau^2}{\pi \cdot \rho_r \cdot \delta'} \quad (31)$$

where:

f_1 – supply voltage frequency;

μ_0 – permeability of vacuum (air),

$\mu_0 = 4 \cdot \pi \cdot 10^{-7} \text{ H/m}$;

τ – polar pitch obtained with relation (28);

ρ_r – resistivity corrected surface;

δ' – equivalent air gap.

20. Slot's useful area.

Since, for both inductors, the slots are of identical size, placed „face to face” in relation to induced, shows that relevant areas of the slots are identical for both inductors. Recommended [8], useful surface of slot determine the relationship:

$$S_{ucr} = (h_c - 2 \cdot g_{iz} - h_p) \cdot (b_c - g_{iz}) \quad (32)$$

where: h_c – slot depth;

b_c – slot width;
 h_p – upper insulation height of slot, $h_p = (1 + 2) \cdot 10^{-3}$ m;
 g_{iz} – thickness of insulation; $g_{iz} = 0,22 + 0,5$ mm for insulation class F, the supply voltage $U_n \leq 1000$ V;

Conclusions

The algorithm presented provides consistency calculations for determining the parameters of induction motors with bilateral arc inductor, radial air gap and nozzle induced (MAIABIRID). It was used in making a model of MAIABIRID used in power plants active government.

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A LQR CONTROLLER SYNTHESIS FOR DEPTH CHANGING FOR AN AUTONOMOUS UNDERWATER VEHICLE

Paul Burlacu¹

¹ Lt.cdor.dr.ing. Academia Navală „Mircea cel Bătrân”

Abstract- This study will present a design for the control of depth changing system for an autonomous underwater vehicle. This design will also be based on a linearized model of the underwater vehicle.

Keywords: linearization, open loop scheme, closed loop scheme, optimal controller, simulations.

1. INTRODUCTION

This article will present a development of the control systems for depth changing, system which is considered to be decoupled from the entire system of the underwater vehicle control.

To obtain diving equations of motion it is compulsory to begin with the general equations of motion. These are nonlinear, so, the logic step will be the obtaining the linear equations of underwater vehicle motion. This linearization will be made around the equilibrium point, where we can approximate the entire behavior of the vehicle. For the close loop scheme we need to synthesize a controller. We already chose an optimal controller because this one is fitted for our underwater vehicle needs.

2. THE AUTONOMOUS UNDERWATER VEHICLES EQUATIONS

To obtain diving equations of motion we must begin with the general motion equations. These are nonlinear, so, for simplify we will try to decouple the system for depth and pitch control.

The nonlinear equations of underwater vehicle motions are:

$$m[\dot{u} + qw - rv - x_G(q^2 + r^2) + y_G(pq - \dot{r}) + z_G(pr - \dot{q})] = X$$

$$m[\dot{v} + ru - pw - y_G(r^2 + p^2) + z_G(qr - \dot{p}) + x_G(qp + \dot{r})] = Y \quad (1)$$

$$m[\dot{w} + pv - qu - z_G(p^2 + q^2) + x_G(rp - \dot{q}) + y_G(rq + \dot{p})] = Z$$

$$I_x \dot{p} + (I_z - I_y)qr + m[y_G(\dot{w} + pv - qu) - z_G(\dot{v} + ru - pw)] = K$$

$$I_y \dot{q} + (I_x - I_z)rp + m[z_G(\dot{u} + qw - rv) - x_G(\dot{w} + pv - qu)] = M \quad (2)$$

$$I_z \dot{r} + (I_y - I_x)pq + m[x_G(\dot{v} + ru - pw) - y_G(\dot{u} + qw - rv)] = N$$

From these equations the matrix form is:

$$M_{RB} \dot{v} + C_{RB}(v)v = \tau_{RB} \quad (3)$$

where:

M_{RB} – inertial matrix;
 C_{RB} – coriolis forces and centripetal forces of rigid body matrix;

τ_{RB} – forces and moments vectors of rigid body.

Further, the other form of the equations (3) is:

$$M\dot{v} + C(v)v + D(v)v + g(\eta) = \tau \quad (4)$$

where

$$M = M_{RB} + M_A; C(v) = C_{RB}(v) + C_A(v) \quad (5)$$

M_A – adherent masses forces matrix;

C_A – coriolis forces and centripetal forces of adherent masses forces matrix;

$D(v)$ – total matrix of damping forces;

τ – propulsion forces and moments.

The linearized form for these equations are:

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -M^{-1}[C(t) + D(t)] & -M^{-1}G(t) \\ J(t) & J^*(t) \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} M^{-1} \\ 0 \end{bmatrix} u \quad (6)$$

$$\dot{x} = A(t)x + B(t)u \quad (7)$$

The diving equations of motion for the underwater vehicle should include the heave velocity w , the angular velocity in pitch q , the pitch angle Θ , the depth z and the stern plane deflection δ_s . Assuming that the forward speed is constant and the sway and yaw modes can be neglected, the pitch and heave kinematics can be perturbed.

3. THE REPRESENTATION OF THE OPEN LOOP SIMULATION FOR THE NONLINEAR SYSTEM

In the beginning it is necessary to start with the simulation for the nonlinear model in the open loop scheme.

The structure of our underwater vehicle is presented in fig. 1.

This model has 416 N of damping force.

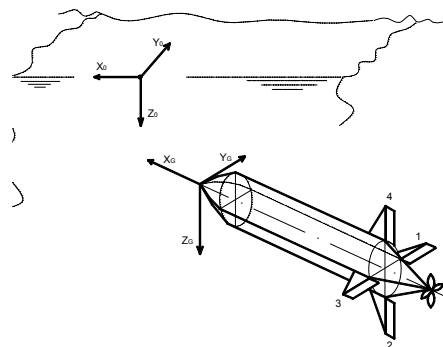


Fig.1 The autonomous underwater vehicle structure

For this simulation it has been considered that the extern perturbations zero and the fins angles having the same value, zero. The open loop scheme is presented in fig. 2.

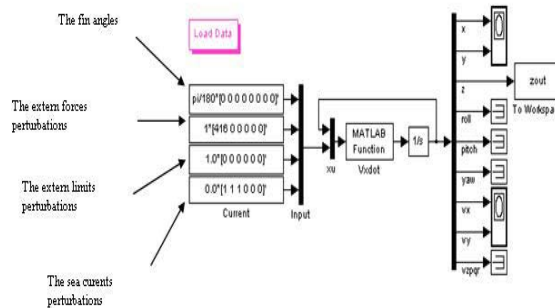


Fig.2 The open loop scheme for nonlinear system

The results obtained after the simulations are presented in figures 3 and 4.

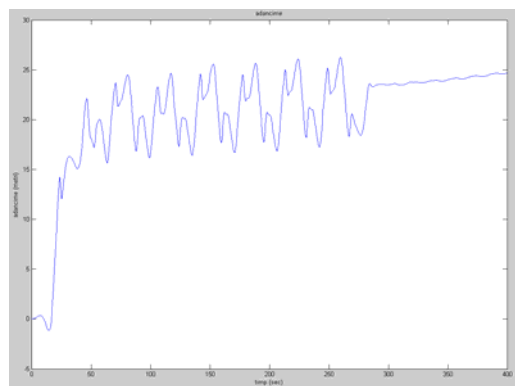


Fig.3 The depth variation of the open loop model

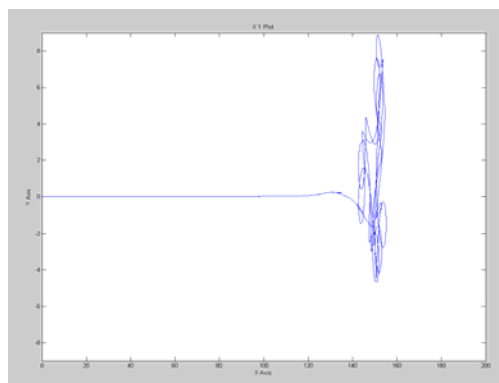


Fig.4 The horizontal plane trajectory of an open loop system

After studying the diagrams from the figures 3 and 4 we can conclude that, the fixed part of the system, which is the vehicle body, has an unstable dynamic behavior for the both planes, horizontal and vertical.

4. THE REPRESENTATION OF THE CLOSED LOOP SIMULATION FOR THE LINEAR SYSTEM

If we consider the necessity of the underwater vehicles we should synthesize some controllers for changing and maintaining the depth and for the steering mode of an underwater vehicle.

Further, we will consider just the system for the depth changing.

Starting with the linearised form of movement equations, we consider that, the command vector δ being formed by the angles from the four fins and the external forces and moments.

The linearized equation will become:

$$\dot{x} = A(t)x + B(t)B^+ \begin{bmatrix} \delta & u_1 \end{bmatrix}^T \tag{8}$$

where:

$$\delta = [\delta_1 \quad \delta_2 \quad \delta_3 \quad \delta_4]^T \text{ - the fins angles vector;}$$

$u_1 = [X \ Y \ Z \ K \ M \ N]^T$ - the external forces and moments vector.

For the simulation, the linearized model will be around the equilibrium points where we have the values for the hydrodynamic coefficients:

- nominal forward velocity – 3 m/s;
- damping force – 416 N;
- nominal depths – 0; 7 and 14 meters.

The equilibrium point is:

$$x_0 = [0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 3 \ 0 \ 0 \ 0 \ 0 \ 0]^T$$

with the entrances

$$u_0 = [0 \ 0 \ 0 \ 0 \ 416 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0]^T$$

The model of the system will be:

$$\dot{x} = Ax + Bu \tag{9}$$

with the matrixes:

$$A = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 3 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -3 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0.1107 & 0 & -0.1872 & 0 & 0.3542 & 0 & 0.7126 & 0 \\ 0 & 0 & 0 & -1.842 & 0 & 0 & 0 & 0.3425 & 0 & -1.692 & 0 & 0.7826 \\ 0 & 0 & 0 & 0 & 0.5946 & 0 & -0.01122 & 0 & 0.3006 & 0 & -1.108 & 0 \\ 0 & 0 & 0 & -1302 & 0 & 0 & 0 & 0.3826 & 0 & -11.95 & 0 & -2.477 \\ 0 & 0 & 0 & 0 & -0.6568 & 0 & 0.0124 & 0 & -2.102 & 0 & -4.229 & 0 \\ 0 & 0 & 0 & -0.7839 & 0 & 0 & 0 & 2.112 & 0 & -0.7199 & 0 & -4.351 \end{bmatrix} \tag{10}$$

$$B = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0.2729 & 0 & -0.2729 & 0 & 67.43e-5 & 0 & 4.042e-5 & 0 & -4.464e-5 & 0 & 0 & 0 \\ -1.118 & -1.759 & -1.118 & -0.4779 & 0 & 66.53e-5 & 0 & 74.32e-5 & 0 & 28.31e-5 & 0 & 0 \\ 0.5488 & 0 & -0.5488 & 0 & 4.042e-5 & 0 & 56.15e-5 & 0 & -23.99e-5 & 0 & 0 & 0 \\ -7.903 & -8.618 & -7.903 & -7.187 & 0 & 74.32e-5 & 0 & 521.1e-5 & 0 & 31.62e-5 & 0 & 0 \\ -1.619 & 0 & 1.619 & 0 & -4.464e-5 & 0 & -23.99e-5 & 0 & 26.49e-5 & 0 & 0 & 0 \\ -0.4759 & -2.128 & 0.4759 & 1.176 & 0 & 28.31e-5 & 0 & 31.62e-5 & 0 & 28.23e-5 & 0 & 0 \end{bmatrix} \tag{11}$$

For the 7 and 14 meters depths the linearised models will have the same structure because the depth doesn't count for the system dynamic.

After the decoupling the control systems, the equation for depth changing has the form:

$$\dot{x} = ax + b\delta \tag{12}$$

where:

$$x = [z \ \theta \ u \ w \ q]^T \tag{13}$$

$$\delta = [\delta_1 \ \delta_2 \ \delta_3 \ \delta_4]^T \tag{14}$$

$$a = \begin{bmatrix} 0 & -3 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 0.1107 & -0.1872 & 0.3542 & 0.7126 \\ 0 & 0.5946 & -0.01122 & 0.3006 & -1.108 \\ 0 & -0.6568 & 0.0124 & -2.102 & -4.229 \end{bmatrix} \tag{15}$$

$$b = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0.2729 & 0 & -0.2729 & 0 \\ 0.5488 & 0 & -0.5488 & 0 \\ -1.619 & 0 & 1.619 & 0 \end{bmatrix} \tag{16}$$

The system has the eigenvalues:

$$e = 0, -4.6172, 0.3433 + 0.33171 * i, 0.3433 - 0.33171 * i, -0.1852 \tag{17}$$

We observe that the decoupled system for depth changing is at the limit of the stability. We consider this, and we will introduce an optimal controller for the system.

The closed loop system is presented in figure 5.

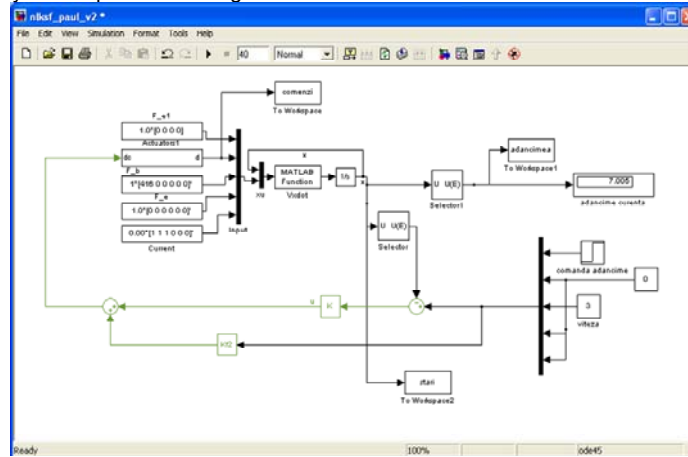


Fig.5 The closed loop scheme for the underwater vehicle

Simulations have two cases:

Case 1

- initial depth 0 and the command for the depth 7 will be after 5 seconds.

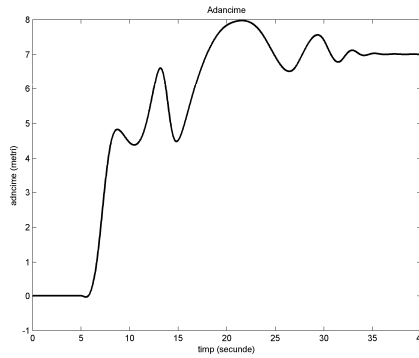


Fig.6 Changing the depth, from 0 to 7 meters

Case 2

- Initial depth 7, and the command for depth 14 will be after 5 seconds.

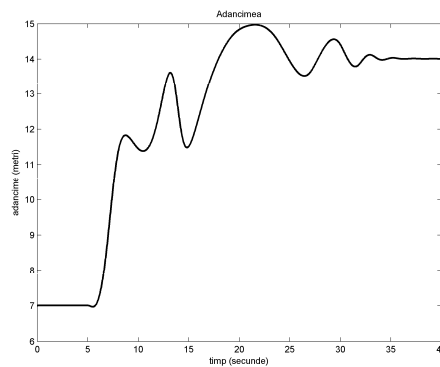


Fig.7 Changing the depth from 7 to 14 meters

In figure 8 it can see the command angles for the fins 1 and 3 which are used for depth changing.

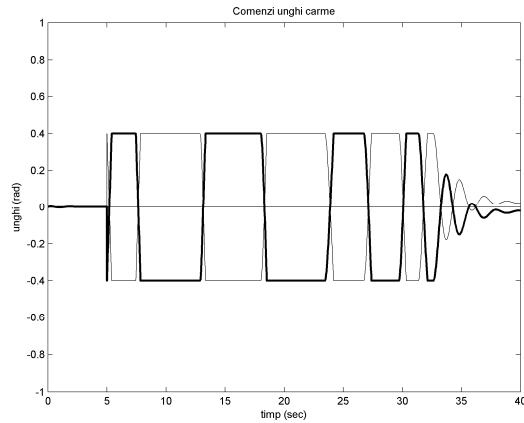


Fig.8 The fins angles command

5. CONCLUSION

The System is not total decoupled so this was the reason for using an optimal controller.

Analyzing those two simulations from the article we can consider that, the system dynamic doesn't depend on the depth.

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He would be able to have *script1.php* output any PHP code that he or she wanted your script to execute. Imagine if the user sent code to delete content from your database or even send sensitive information directly to the browser.

The solution is: validate the input. One method of validation would be to create a list of acceptable pages. If the input did not match any of those pages, an error could be displayed.

```
$pages = array('index.html', 'page2.html',  
'page3.html');  
if( in_array($page, $pages) )  
{  
    include($page);  
}  
else  
{  
    die("Bye Bye");  
}
```

2.2. Using eval() function

Placing user-inputted values into the eval() function can be extremely dangerous. You essentially give the malicious user the ability to execute any command he or she wishes! You may envision the input coming from a drop-down menu of options you specify, but you user may decide to send input like this:

```
script.php?input=;passthru("cat /etc/passwd");
```

By putting his own code in that statement, the user could cause your program to output your server's complete */etc/passwd* file.

Use eval() sparingly, and by all means, validate the input. It should only be used when absolutely necessary -- when there is dynamically generated PHP code. If you are using it to substitute template variables into a string or substitute user-inputted values, then you are using it for the wrong reason. Try sprintf() or a template system instead.

2.3. Using register_globals = ON

This has been a major issue since this feature was invented. It was originally designed to make programming in PHP easier (and that it did), but misuse of it often led to security holes. As of PHP 4.2.0, register_globals is set to OFF by default. It is recommended that you use the superglobals to deal with input (\$_GET, \$_POST, \$_COOKIE, \$_SESSION, etc).

For example, let us say that you had a variable that specified what page to include:

```
include($page);
```

but you intended \$page to be defined in a config file or somewhere else in the script, and not to come as user input. In one instance you forgot to pre-define \$page. If register_globals is set to ON, the malicious user can take over and define \$page for you, by calling your script like this:

```
script.php?page=http://www.anmb.ro/script1.php
```

We recommend you develop with register_globals set to OFF, and use the superglobals when accessing user input. In addition, you should always develop with full error reporting, which can be specified like this (at the top of your script):

```
error_reporting(E_ALL);
```

This way, you will receive a notice for every variable you try to call that was not previously defined. Yes, PHP does not require you to define variables so there may be notices that you can ignore, but this will help you to catch undefined variables that you did expect to come from input or other sources. In the previous example, when \$page was

referenced in the include() statement, PHP would issue a notice that \$page was not defined.

Whether or not you want to use register_globals is up to you, but make sure you are aware of the advantages and disadvantages of it and how to remedy the possible security holes.

2.4. Run unescaped queries

PHP has a feature, enabled by default, that automatically escapes (adds a backslash in front of) certain characters that come in from a GET, POST, or COOKIE. The single quote (') is one example of a character that is escaped automatically. This is done so that if you include input variables in your SQL queries, it will not treat single quotes as part of the query.

But let's take the following example, in the form what permits access for students based on their CNP we used the following query:

```
$query='select cod,cnp,clasa,grupa as clasa2 from  
date_std where cnp="'. $cnp. "'";
```

1. *magic_quotes_gpc* On
2. *\$cnp=1 or 1=1*

3. *Surprise, this interrogation running: select cod_s from tb_stud where cnp="1 or 1=1" and will return a valid result.*

The resulted interogation will be:

```
select cod_s from tb_stud where cnp="1 or 1=1"
```

To prevent such as situation we'll cast the incoming data to float:

```
$cnp=(float)$cnp;
```

A cast forces PHP to perform a type conversion. If the input is not entirely numeric, only the numeric portion is used. If the input doesn't start with a numeric value or if the input is only alphabetic and punctuation characters, the result of the cast is 0.

In some configurations, magic_quotes_gpc (the feature that automatically adds slashes to all input) is actually set to OFF. You can use the function get_magic_quotes_gpc() to see if it's on or not (it returns true or false). If it returns false, simply use addslashes() to add slashes to all of the input (it is easiest if you use \$_POST, \$_GET, and \$_COOKIE or \$HTTP_POST_VARS, \$HTTP_GET_VARS, and \$HTTP_COOKIE_VARS, instead of globals because you could step through those arrays using a foreach() loop and add slashes to each one).

2.5. Do not use sessions or validate the login every time

There are some cases where programmers will only use some sort of login.php script to first validate their username and password (entered through a form), test if they're an administrative or valid user, and actually set a variable through a cookie, or even hide it as a hidden variable. Then in the code, they check to see if they have access like this:

```
if($admin)  
{  
    // let them in  
}  
else  
{  
    // kick them out  
}
```

The above code makes the fatal assumption that the \$admin variable can only come from a cookie or input form that the malicious user has no control over. However, that is simply not the case. With register_globals enabled, injecting designed input into the \$admin variable is as easy as calling the script like so:

```
script.php?admin=1
```

Furthermore, even if you use the superglobals \$_COOKIE or \$_POST, a malicious user can easily forge a cookie or create his own HTML form to post any information to your script.

There are two good solutions to this problem. One is on the same track as setting an \$admin variable, but this time set \$admin as a session variable. In this case, it is stored on the server and is much less likely to be forged. On subsequent calls to the same script, your user's previous session information will be available on the server, and you will be able to verify if the user is an administrator like so:

```
if( $_SESSION['admin'] )
```

The second solution is to only store their username and password in a cookie, and with every call to the script, validate the username and password and verify if the user is an administrator. You could have two functions -- one called validate_login(\$username,\$password) that verified the user's login information, and one called is_admin(\$username) that queried the database to see if that username is an administrator. The code would be placed at the top of any protected script:

```
if( !validate_login( $_COOKIE['username'],  
$_COOKIE['password'] ) )  
{  
    echo "Invalid login";  
    exit;  
}  
// the login is ok if we made it down here  
if( !is_admin( $_COOKIE['username'] ) )  
{  
    echo "Sorry, you do not have access to this section";  
    exit;  
}
```

Personally we recommend using sessions, as the latter solution is not scalable.

2.6. The file with an inadequate extension

It was common practice for awhile to name include files or library files with a .inc extension. Here's the problem: if a malicious user simply enter the .inc file into his browser, it will be displayed as plain text, not parsed as PHP. Even if the browser did not like the file type, an option to download it would most likely be given. Imagine if this file had your database login and password, or even more sensitive information.

This goes for any other extension other than .php (and a few others), so even a .conf or a .cfg file would not be safe.

The solution is to put a .php extension on the end of it. Since your include files or config files usually just define variables and/or functions and not really output anything, if your user were to load this, for example, into their browser:

```
http://yoursite.ro/lib.inc.php
```

they would most likely be shown nothing at all, unless of your lib.inc.php outputs something. Either way, the file would be parsed as PHP instead of just displaying your code.

There are also some reports of people adding Apache directives that will deny access to .inc files; however,

I do not recommend this because of the lack of portability. If you rely on .inc files and that Apache directive to deny access to them and one day you move your scripts to another server and forget to place the Apache directive in, you are wide open.

3. Processing User Data – Form Input Verification & HTML Display

Validating Input And Stripping Tags

When a user enters information into a form which is to be later processed on your site, they have the power to enter anything they want. Code which processes form input should be carefully written to ensure that the input is as requested; password fields have the required level of complexity, e-mail fields have at least some characters, an @ sign, some more characters, a period, and two or more characters at the end, zip or postal codes are of the required format, and so on.

Each of these may be verified using regular expressions, which scan the input for certain patterns. An example for e-mail address verification is the PHP code shown below. This evaluates to true if an e-mail address was entered in the field named 'email'.

```
preg_match('/^.+@.+.{2,3}$/', $_POST['email']);
```

This code just constructs a regular expression based on the format described above for an e-mail address. Note that this will return true for anything with an @ sign and a dot followed by 2 or 3 characters. That is the general format for an e-mail address, but it doesn't mean that address necessarily exists; you'd have to send mail to it to be sure of that.

Interesting as this is, how does it relate to security? Well, consider a guestbook as an example. Here, users are invited to enter a message into a form, which then gets displayed on the HTML page along with everyone else's messages. For now, we won't go into database security issues, the problems dealt with below can occur whether the data is stored in a database, a file, or some other construct.

If a user enters data which contains HTML, or even JavaScript, then when the data is included into your HTML for display later, their HTML or JavaScript will also get included.

If your guestbook page displayed whatever was entered into the form field, and a user entered the following,
I like your web site.

Then the effect is minimal, when displayed later, this would appear as,
I like your web site.

Of course, when the user enters JavaScript, things can get a lot worse. For example, the data below, when entered into a form which does not prevent JavaScript ending up in the final displayed page, will cause the page to redirect to a different website. Obviously, this only works if the client has JavaScript enabled in their browser, but the vast majority of users do.

```
Welcome to our site!<script  
language="JavaScript">document.location="http://www.anmb.  
ro/";</script>
```

For a split second when this is displayed, the user will see,
Welcome to our site!

The browser will then kick in and the page will be refreshed from www.anmb.ro. In this case, a fairly harmless alternative page, although it does result in a denial of service attack; users can no longer get to your guestbook.

Consider a case where this was entered into an online order form. Your order dispatchers would not be able to view the data because every time they tried, their browser would redirect to another site. Worse still, if the redirection occurred on a critical page for a large business, or the

redirection was to a site containing objectionable material, custom may be lost as a result of the attack.

Fortunately, PHP provides a way to prevent this style of PHP hack attack. The functions `strip_tags()`, `nl2br()` and `htmlspecialchars()` are your friends, here.

- `strip_tags()` removes any PHP or HTML tags from a string. This prevents the HTML display problems, the JavaScript execution (the `<script>` tag will no longer be present) and a variety of problems where there is a chance that PHP code could be executed.

- `nl2br()` converts newline characters in the input to `
` HTML tags. This allows you to format multi-line input correctly, and is mentioned here only because it is important to run `strip_tags()` prior to running `nl2br()` on your data, otherwise the newly inserted `
` tags will be stripped out when `strip_tags()` is run!

- `htmlspecialchars()` will entity-quote characters such as `<`, `>` and `&` remaining in the input after `strip_tags()` has run. This prevents them being misinterpreted as HTML and makes sure they are displayed properly in any output.

Having presented those three functions, there are a few points to make about their usage. Clearly, `nl2br()` and `htmlspecialchars()` are suited for output formatting, called on data just before it is output, allowing the database or file-stored data to retain normal formatting such as newlines and characters such as `&`. These functions are designed mainly to ensure that output of data into an HTML page is presented neatly, even after running `strip_tags()` on any input.

The function `strip_tags()`, on the other hand, should be run immediately on input of data, before any other processing occurs. The code below is a function to clean user input of any PHP or HTML tags, and works for both GET and POST request methods.

```
function _INPUT($name)
{
    if ($_SERVER['REQUEST_METHOD'] == 'GET')
        return strip_tags($_GET[$name]);
    if ($_SERVER['REQUEST_METHOD'] == 'POST')
        return strip_tags($_POST[$name]);
}
```

This function could easily be expanded to include cookies in the search for a variable name. I called it `_INPUT` because it directly parallels the `$_` arrays which store user input. Note also that when using this function, it does not matter whether the page was requested with a GET or a POST method, the code can use `_INPUT()` and expect the correct value regardless of request method. To use this function, consider the following two lines of code, which both have the same effect, but the second strips the PHP and HTML tags first, thus increasing the security of the script.

```
$name = $_GET['name'];
$name = _INPUT('name');
```

If data is to be entered into a database, more processing is needed to prevent SQL injection, which will be discussed later.

Executing Code Containing User Input

Another concern when dealing with user data is the possibility that it may be executed in PHP code or on the system shell. PHP provides the `eval()` function, which allows arbitrary PHP code within a string to be evaluated (run). There are also the `system()`, `passthru()` and `exec()` functions, and the backtick operator, all of which allow a string to be run as a command on the operating system shell.

Where possible, the use of all such functions should be avoided, especially where user input is entered into the command or code. An example of a situation where this can lead to attack is the following command, which would display the results of the command on the web page.

```
echo "Your usage log:<br />";
$username = $_GET['username'];
passthru("cat /logs/usage/$username");
```

`passthru()` runs a command and displays the output as output from the PHP script, which is included into the final page the user sees. Here, the intent is obvious, a user can pass their username in a GET request such as `usage.php?username=mihai` and their usage log would be displayed in the browser window.

But what if the user passed the following URL?

```
usage.php?username=mihai;cat%20/etc/passwd
```

Here, the username value now contains a semicolon, which is a shell command terminator, and a new command afterwards. The `%20` is a URL-Encoded space character, and is converted to a space automatically by PHP. Now, the command which gets run by `passthru()` is, `cat /logs/usage/mihai;cat /etc/passwd`

Clearly this kind of command abuse cannot be allowed. An attacker could use this vulnerability to read, delete or modify any file the web server has access to. Luckily, once again, PHP steps in to provide a solution, in the form of the `escapeshellarg()` function. `escapeshellarg()` escapes any characters which could cause an argument or command to be terminated. As an example, any single or double quotes in the string are replaced with `\'` or `\"`, and semicolons are replaced with `\;`. These replacements, and any others performed by `escapeshellarg()`, ensure that code such as that presented below is safe to run.

```
$username = escapeshellarg($_GET['username']);
passthru("cat /logs/usage/$username");
```

Now, if the attacker attempts to read the password file using the request string above, the shell will attempt to access a file called `/logs/usage/mihai;cat /etc/passwd`, and will fail, since this file will almost certainly not exist.

It is generally considered that `eval()` called on code containing user input be avoided at all costs; there is almost always a better way to achieve the desired effect. However, if it must be done, ensure that `strip_tags` has been called, and that any quoting and character escapes have been performed.

Combining the above techniques to provide stripping of tags, escaping of special shell characters, entity-quoting of HTML and regular expression-based input validation, it is possible to construct secure web scripts with relatively little work over and above constructing one without the security considerations. In particular, using a function such as the `_INPUT()` presented above makes the secure version of input acquisition almost as painless as the insecure version PHP provides.

4. Example of data secures function

We recommend trying transformation of the special characters in entities.

```
function secure_it($ce)
{
    $secured=str_replace("'", "&#34;", $ce);
    $secured=str_replace('"', "&#39;", $secured);
    $secured=str_replace("-", "&#45;", $secured);
    $secured=str_replace("+", "&#43;", $secured);
    $secured=str_replace(".", "&#44;", $secured);
    $secured=str_replace(":", "&#58;", $secured);
    $secured=str_replace(";", "&#59;", $secured);
    $secured=str_replace("<", "&#60;", $secured);
    $secured=str_replace(">", "&#62;", $secured);
    $secured=str_replace("&", "&#38;", $secured);
    $secured=str_replace("%", "&#37;", $secured);
    $secured=str_replace("$", "&#36;", $secured);
    $secured=str_replace("=", "&#61;", $secured);
    $secured=str_replace("?", "&#63;", $secured);
    $secured=str_replace("(", "&#40;", $secured);
    $secured=str_replace(")", "&#41;", $secured);
    $secured=str_replace("&#", "&#35;", $secured);
    $secured=str_replace("&#123;", "&#123;", $secured);
    $secured=str_replace("}", "&#125;", $secured);
}
```

```
$secured=str_replace("\'", "&#92;", $secured);
```

```
return $secured;  
}
```

5. Conclusions

Always keep the following principles in mind when designing your scripts:

1. Never include, require, or otherwise open a file with a filename based on user input, without thoroughly checking it first.

2. Be careful with eval() function

3. Be careful when using register_globals = ON

4. Never run unescaped queries

5. For protected areas, use sessions or validate the login every time.

6. If you don't want the file contents to be seen, give the file a .php extension.

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INTEGRAL OPERATORS OF POTENTIAL TYPE

Petronela CATANA¹

Dumitru Dan PASCALI²

¹Lecturer Ph.D, “Dimitrie Cantemir”, Faculty of Tourism and Commercial Management Constanta, Christian University Bucharest, Romania

²Full Professor Ph.D, Courant Institute of Mathematical Sciences New York University, USA

Abstract: In order to prove the Sobolev imbedding theorem we shall establish an integral representation of continuous differentiable functions and discuss some properties of integral operators with a polar Kernel.

Keywords: compact operators, integral operators, representation of integral operators

1. Introduction

The first attempts to solve nonlinear functional equations have involved different aspects of compactness. The fixed point theory has played a decisive role in this area. We consider that are satisfied the properties of compact maps in finite-dimensional cases and the operators of monotone type extend some of these properties to infinite-dimensional spaces. We collected and we used results well known results of compact operators, Sobolev imbeddings and the fixed point theory to give an integral representation of continuous differentiable functions and to put in discussions some properties of integral operators of potential type (with a polar type Kernel).

2. Linear integral operators

Let $\Omega \subset \mathbb{R}^N$ and $\Omega' \subset \mathbb{R}^N$ be two bounded domains with $N \geq N'$. If $k : \overline{\Omega} \times \Omega' \rightarrow \mathbb{R}$ is a continuous Kernel, then the linear map $u = Pv$ defined by:

$$u(x) = \int_{\Omega} k(x, y)v(y)dy \quad (1)$$

is a compact operator from $L^1(\Omega)$ into $C(\overline{\Omega'})$

The following theorem shows the conditions for the Kernel $k(x,y)$, which make P a mapping from $L^p(\Omega)$ into $L^q(\Omega')$.

Theorem 2.1. Suppose that there exist two numbers $s, t > 1$ with the following properties :

- (a) $\left(\int_{\Omega} |k(x, y)|^s dx \right)^{\frac{1}{s}} \leq c_1$ a.e. $y \in \Omega'$
- (b) $\left(\int_{\Omega} |k(x, y)|^t dy \right)^{\frac{1}{t}} \leq c_2$ a.e. $x \in \Omega'$
- (c) $q \geq p, q \geq s$ and $\left(1 - \frac{s}{q}\right)p' < t$

Then P is a compact operator from $L^p(\Omega)$ into $L^q(\Omega')$ and $\|P\| \leq C_1^{\frac{s}{q}} C_2^{1 - \frac{s}{q}}$

If the third condition in (c) is weakened to become $\left(1 - \frac{s}{q}\right)p' \leq t$ then the operator $P : L^p(\Omega) \rightarrow L^q(\Omega')$ need not be compact but it is still continuous (for proof, see [1])

3. Integral operators of potential type

Let Ω be a bounded convex domain in \mathbb{R}^N of diameter δ and let $u \in C^1(\Omega)$. Then we have the representation

$$u(x) = \frac{1}{\mu(\Omega)} \int_{\Omega} u(y)dy - \int_{\Omega} \frac{k(x, y) \cdot \nabla u(y)}{|x - y|^{N-1}} dy \quad (2)$$

where $k : \Omega \times \Omega \rightarrow \mathbb{R}^N$ is bounded and continuous for $x, y \in \Omega, x \neq y$ and

$$|k(x, y)| \leq \frac{\delta^N}{\mu(\Omega)} \quad (3)$$

For any fixed $x \in \Omega$ we can describe other point $y \in \Omega$ by specifying the distance $R = |x - y|$ and the unit vector ρ directed from x to y such that $y = x + R\rho$. Then:

$$u(x) = u(y) - \int_0^R \frac{\partial u}{\partial \rho} d\rho \quad (4)$$

We will multiply this equality by $R^{N-1}dR$ and we will integrate it with respect to R between 0 and $d = d(\rho)$ from point x along the radius vector ρ , where $d(\rho)$ is the length in this direction within Ω . Thus,

$$u(x) \int_0^d R^{N-1} dR = \int_0^d u(y) R^{N-1} dR - \int_0^d R^{N-1} dR \int_0^R \frac{\partial u(y)}{\partial \rho} d\rho = \int_0^d u(y) R^{N-1} dR - \int_0^d \frac{\partial u(y)}{\partial \rho} \left(\int_0^d R^{N-1} dR \right) d\rho =$$

$$\int_0^d u(y) R^{N-1} dR - \int_0^d \frac{d^N - \rho^N}{N} \frac{\partial u(y)}{\partial \rho} \frac{1}{\rho^{N-1}} \rho^{N-1} d\rho$$

If we change the notation in the last integral by putting R instead of ρ and multiply both sides of the equality by the elementary solid angle $d\sigma$, which is the surface element of the unit sphere $S \subset \mathbb{R}^N$ and if we use the formula

$$\int_{\Omega} v(y) dy = \int_S d\sigma \int_0^d v(y) R^{N-1} dR \quad \text{we will obtain} \quad u(x) \mu(\Omega) = \int_{\Omega} u(y) dy - \int_{\Omega} \frac{d^N - R^N}{N} \frac{\partial u(y)}{\partial \rho} \frac{1}{R^{N-1}} dy$$

Since $\frac{u(y)}{\partial \rho} = \rho \nabla u$ we got the representation (2) with $k(x, y) = \frac{d^N - R^N}{N \mu(\Omega)} \rho$.

Among the consequences of this equality there are inequality (3) and the fact that $k(x, y)$ is continuous. We can investigate the representation (2) of integral operators of potential type

$$u(x) = \int_{\Omega} \frac{k(x, y)}{|x - y|^{\lambda}} v(y) dy, \quad \text{where } \lambda < N$$

This map defines a linear operator $u = P_{\lambda} v$ in $L^p(\Omega)$ with $p \geq 1$. Let p' be conjugate number of p. Then following theorem take place:

Theorem 3.1. If $\lambda < \frac{N}{p}$, the map $P_{\lambda} : L^p(\Omega) \rightarrow C(\overline{\Omega})$ is compact

Proof: Under the hypothesis:

$$|k(x, y)| \leq k, k > 0$$

$B(0, R) \equiv B$ a ball which contains Ω

$$r = |x - y|$$

Holder's inequality yields $|u(x)| \leq k \|v\|_p \left(\int_B r^{-\lambda p'} dy \right)^{\frac{1}{p}}$

In spherical coordinates with pole at x we have $dy = r^{N-1} dr d\sigma$ and

$$\int_B r^{-\lambda p'} dy \leq \int_0^{2R} r^{N-\lambda p'-1} dr \int_S d\sigma = \frac{|S|}{N - \lambda p'} (2R)^{N-\lambda p'} \quad (5)$$

Hence $|u(x)| \leq k \left(\frac{|S|}{N - \lambda p'} \right)^{\frac{1}{p}} (2R)^{\frac{N-\lambda}{p}} \|v\|_p$ and the boundedness of P is proved.

Using Arzela-Ascoli theorem it remains to prove the equi-continuity of all functions $u(x)$.

Let $\delta > 0$ and $\Omega_{\delta} = \{y \in R / |y - x| \geq \delta\}$

For $h \in R^n$ with $|h| < \frac{\delta}{2}$ and $x + h \in \Omega$ one has

$$|u(x+h) - u(x)| \leq \int_{\Omega_{\delta}} \left| \frac{k(x, y)}{|x - y|^{\lambda}} - \frac{k(x+h, y)}{|x+h - y|^{\lambda}} \right| |v(y)| dy + k \int_{\Omega - \Omega_{\delta}} \frac{|v(y)|}{|x - y|^{\lambda}} dy + k \int_{\Omega - \Omega_{\delta}} \frac{|v(y)|}{|x+h - y|^{\lambda}} dy$$

For each $\varepsilon > 0$ there exists a $\delta > 0$ such that the first integral is less than ε provided that $|h| \leq \eta$, by the continuity of

$k(x, y)$. For the others integrals we have $|x - y| \leq \delta$ and $|x+h - y| \leq \frac{3\delta}{2}$.

Applying the estimate (5) with $2r = \delta$ and $2R = \frac{3\delta}{2}$

$$|u(x+h) - u(x)| \leq \left\{ \varepsilon [\mu(\Omega)]^{\frac{1}{p}} + k \left(\frac{|S|}{N - \lambda p'} \right)^{\frac{1}{p}} \left[\delta^{\frac{N-\lambda}{p}} + \left(\frac{3\delta}{2} \right)^{\frac{N-\lambda}{p}} \right] \right\} \|v\|_p$$

Since the choice of ε and δ is arbitrary, the images $u = P_{\lambda} v$ are equi-continuous in $C(\overline{\Omega})$ and P_{λ} is compact.

For $\frac{N}{p} \leq \lambda < N$ we apply theorem 2.1 to integral operators of potential type. The integrability of the Kernel of P_λ , of power s

with respect to x and of power t with respect to y requires that $\lambda s < N'$ and $\lambda t < N$.

We may replace s and t by any number close to $\frac{N'}{\lambda}$ and $\frac{N}{\lambda}$ and the assumption (c) of theorem 2.1 becomes

$$1 - \frac{N'}{\lambda_q} p' < \frac{N}{\lambda}$$

Solving with respect to q and using $q \leq p$, we get $q < q^* = \frac{N' p}{N - (N - \lambda)p}$, $N' > N - (N - \lambda)p$ (6)

If $N - (N - \lambda)p = 0$ then the number q may be arbitrary. Hence we have the following proposition:

Proposition 3.2. Let $\frac{N}{p} \leq \lambda < N$. Suppose that the conditions given by (6) are fulfilled. Then the operator P_λ is compact

from $L^p(\Omega)$ into $L^q(\Omega')$, where Ω' is an N' -dimensional plane section of Ω , with $N' \leq N$.

The operator P_λ from $L^p(\Omega)$ into $L^{q^*}(\Omega')$ is at least continuous.

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THE EXPERIMENTAL STAND USE FOR THE SUCCESSIVE CUPPING WITH THINNING

Aurelia CHIOIBAȘ¹

¹ Șef lucrări dr ing, Academia Navală „Mircea cel Bătrân”

Abstract: The piece „Tubular rivet”, which to belong to rapid button there is on the experimental research regarding the successive cupping with thinning from strip. The experimental stand was consisted the power cam press (eccentric) type PAI 16 which is installed the dynamometer die for research of drawing. On the die was installed the dynamometer pick-up for register the variation of force during the stroke and on the headwork was installed the inductive displacement pick-up. The signals wich were pulled out from the both pick-up was amplify from dynamic tensometer and sent at oscillograph for amplification and visualization.

Key words: cupping on strip, rapid button, power cam press (eccentric), dynamometer die, dynamometer pick-up, inductive displacement pick-up, dynamic tensometer, oscillograph.

1. Introducere

The piece „Tubular rivet” (characterized by dimensions D, H and 0,4mm thickness), which to belong to rapid button produce by FAM Galati (fig. 1) there is on the experimental research regarding the successive cupping with thinning from strip([1], [2]). This assembly is used in footwear and clothing industrys.

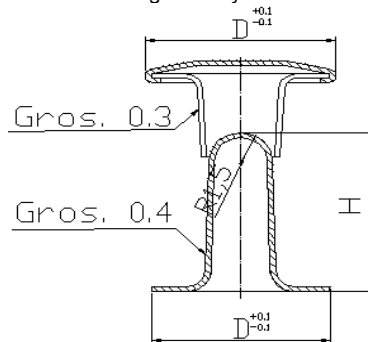


Figure 1. The rapid button

2. The experimental stand use for the successive drawing with thinning

The experimental stand was made of the eccentric PAI 16 which is installed the dynamometer die for research of drawing. On the die was installed the dynamometer pick-up for register the variation of force during the stroke and on the headwork was installed the inductive displacement pick-up. The signals wich were pulled out from the both pick-up was amplified from dynamic tensometer and sent at oscillograph for amplification and visualization.

2.1. The equipment used for drawing

2.1.1. The dynamometer die for drawing research

A. The die construction

The dynamometer die with working part quick change presented in fig. 2 [3] is used for made the experiments regard the drawing research of small pieces. This was made for drawing individual blank and was adapted for successive drawing from strip.

B. The die adaptation for deep-drawing from strip

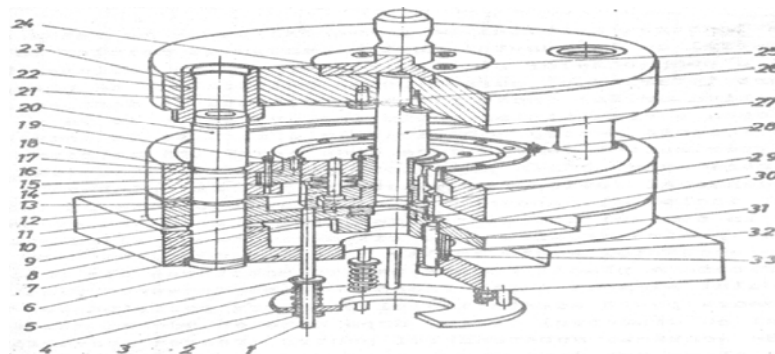


Figure 2. The dynamometer die with working part quick change

For outlet punch from die during deep-drawing is necessary punching of foot plate at 17,6mm (represent the step). In the die-holder 13 is cuttered a slot guide with width 22mm, which is the width of intact strip. If is used the notch strip then is assembled a pin for maintenance of blank in advance direction [4].

2.1.2. The shapes and dimensions of working part used at thinning deep-drawing of strip

The design of the punch, the die and the blank holder are presented in the fig. 3, 4, respectively 5 [4].
 For the working part are available the following technique specification:

- 1) The material: OSC8 STAS 1700;
- 2) The heat treatment: hardened-tempered;
- 3) The hardness: 50-54 HRC.

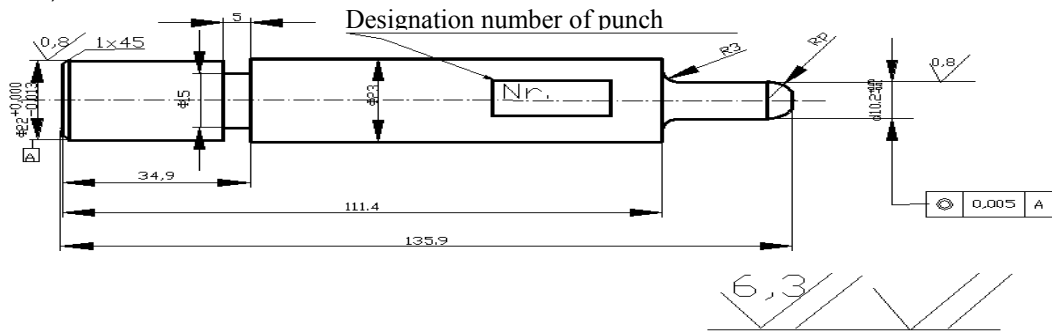


Figure 3. The design of the punch used at deep-drawing

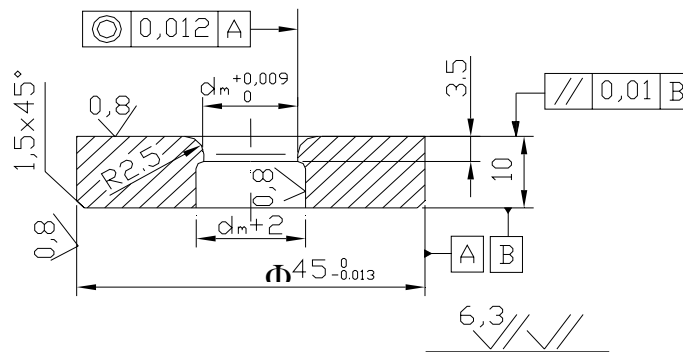


Figure 4. The design of the die used at deep-drawing

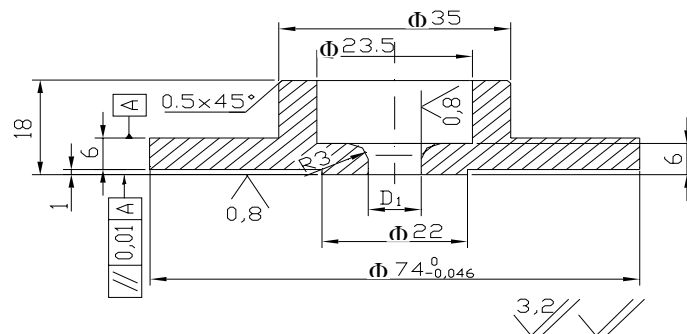


Figure 5. The design of the blank holder

The notice:

- 1) The materialul: C120 STAS 3611 – 80;
- 2) The heat treatment: hardened-tempered;
- 3) The hardness: 42-45 HRC.

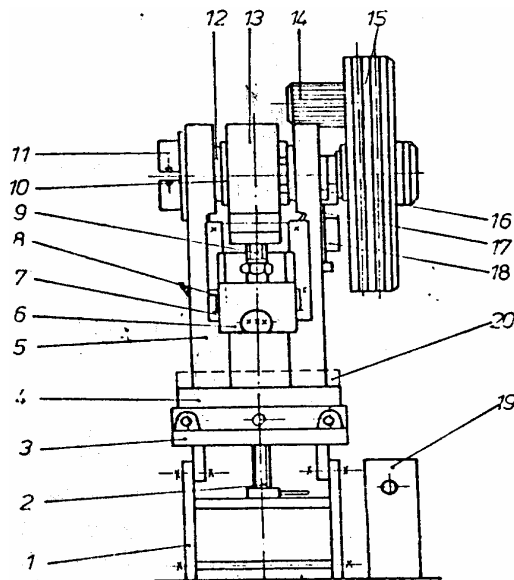


Figure 6. The stamping press PAI 16 scheme

2.1.3. The press

The laboratory tests is made on power cam press (eccentric) PAI 16 which has the arbor parallel with press plate. Their components is presented in fig. 6 [5].

On the press frame 1 is assembled the column 5 with shape „C”, which is solidary with table 4. The column of press can be inclined aid to screw capstan head 2. The column of press is equipped with hammer top guide 6. The eccentric rod 13 is assembled on eccentric bushing 10, which is assembly on eccentric arbor 12. The eccentric rod is made of cap, connecting rod blade and a ball headed bolt, which is articulated through clamping plate, a bolt nut to headwork.

At inferior part of headwork there is a tool hole $\Phi 25$ mm x 60 mm for fastening the superior packet of die. On the headwork is assembly the support for the stroke counter. At right end of eccentric arbor there is the flywheel 15 which receives the motion from electric motor and that transfer of eccentric arbor, through the turning key 16. On the eccentric arbor, between press frame and flywheel, is assembly a cam which does to release for the work „stroke with stroke”. At left end of eccentric arbor is assembly the block brake 11, which annihilates the kinetic energy of arbor after the decoupling of flywheel, which work „stroke with stroke”.

The pressure is controled aid to screw wiht nut, so that the arbor is stoped in desired position.

For the work with continue stroke is necessary releasing of brakes, for not use idle of ferrodo.

The mod of operation selector and control selector there are in general board 19.

The strokes are comandet from the button of board 3. Because press plate isn't adjustable, the press is equipped with supplementary plate 20.

The stroke is comandet through electromagnetic-type relay 18 and levers system 17. The headwork 6 is equipped with a releasing where work the knock-out rod bar 7, wich is actuated from demountable pad 8.

2.1.3. Dynamometric detecting element of die

Is necessary the knowledge of force value and variation during stroke down for an optimum guide of warp process. The measurement of force supposes the transducer resistance utilization ([7], [8], [9]), which based on ownership of electric conductors by changing its electrical resistance to lengthening or shortening them.

Hereby, an insulated conductor wich is fixed on the elastic piece with its actuates a force which determines elastic strain in piece and in conductor, will present a varition of strength electric.

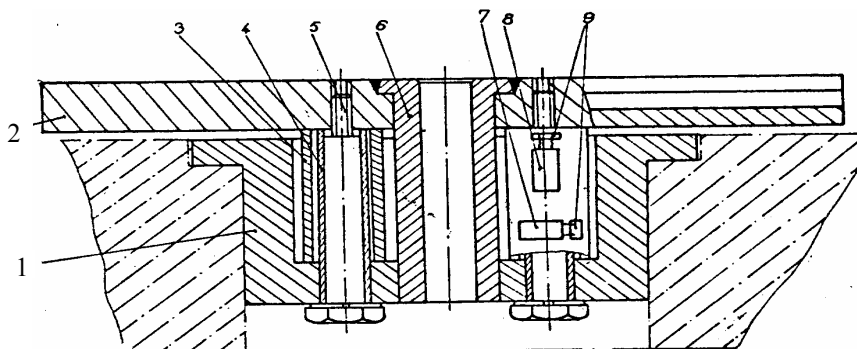


Figure 7. Dynamometric detecting element of die

Therefore, by gauging can introduce a relationship between force and variation tension or intensity of current, which can be measured with the electric instruments [5].

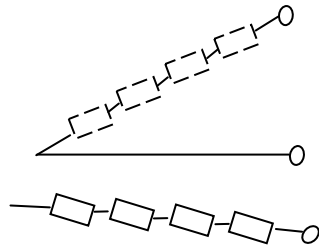


Figure 8. Assembly diagram wiring in semipunte of transducer

The dynamometric detecting element uses at measuring deep-drawing force (fig.7). The active transducers 8 are orientated parallel by bushing axis and transducers 7 are perpendicular by axis because they compensate the effect of temperature variation. The transducers are adhered through the hearts on the intermediary contact 9. The transducer have the support by paper with side of 10 mm, $R=120\Omega$ and sensitivity coefficient $K' = 2,1$.

Assembly diagram wiring in semipunte of transducer (fig. 8) assures the summation of signals given by transducer disposed in axis direction (make with intermitent line), as well as compensation of temperature variation aid transducer disposed perpendicular on axis (make with continue line). This connection in semipunte assures an enlargement factor $K_m=1,3$.

The voltage of detecting element is 4 V. The nominal load of contact pickoff is 160 kN.

For measuring of deep-drawing and retained force of blank flange is made the gauging of detecting element, that is established the correlation between the load F [daN] and the specific strain ε [$\mu\text{m}/\text{m}$], which is readed at electronic strain gauge.

The maximum value of load was 11000 daN. For $F \leq 1000$ daN results a nonlinear relationship, and for large value is obtained linearity ([3], [6]). Result these:

- Right calibration equation, to determine the force measured on $F > 1000$ daN with errors less than 5% and has the expression:

$$F = 1215,436 + 7,228 \cdot \varepsilon. \quad [\text{daN}] \quad (1)$$

- The equation of calibration curve, to determine the force measured for $F > 500$ daN with errors less than 5% and has the expression:

$$\ln F = 6,097833 + 0,189508 \cdot \ln \varepsilon + 0,033963 \cdot (\ln \varepsilon)^2. \quad [\text{daN}] \quad (2)$$

- The calibration equation for $F < 1000$ daN, which predicts the force measured with errors less than 2% is:

$$F = 77,647 + 104,1226 \cdot \varepsilon - 3,052 \cdot \varepsilon^2. \quad [\text{daN}] \quad (3)$$

2.1.4. Inductive displacement transducer

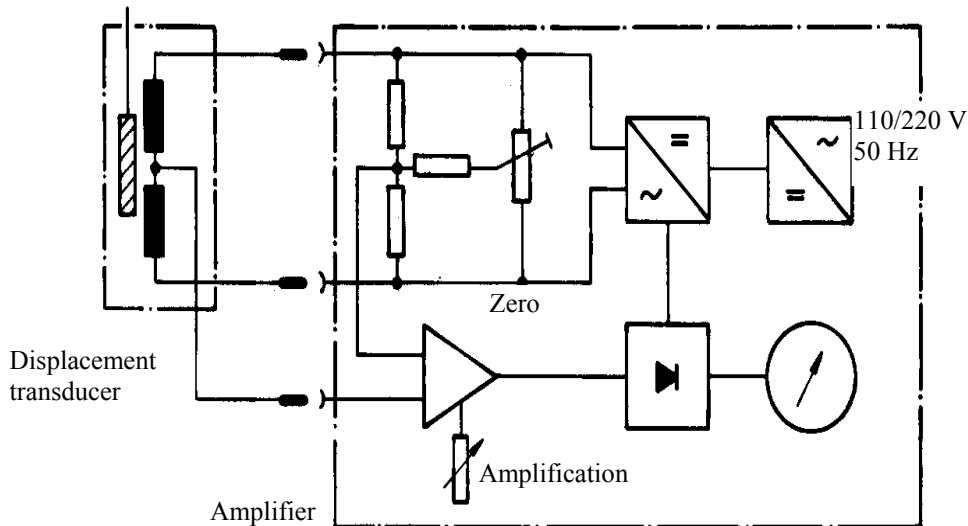


Figure 9. The scheme inductive displacement transducer

Mechanical quantities such as: distance, force, pressure, torsion, deformation and vibration can be converted to travel (by means of appropriate mechanical devices) and can be measured by inductive displacement transducers. It consists of a stainless steel cylindrical body contains a differential coil and a plunger move axially (fig. 9). Coil is coupled through a Wheatstone bridge to an amplifier. Plunger movement entails coil impedance change and disrupting the Wheatstone bridge [8]. W 10 series inductive displacement transducer is fed to a frequency of 5 kHz and a voltage of 1...6 V.

2.2. Block diagram of the measuring stand

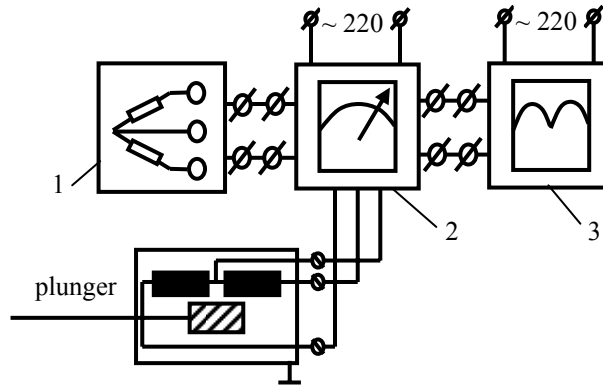


Figure 10. The block diagram of the stand

To measure and visualize the variation of force along stroke the signal is collected separately from contact pickoff dynamometer and inductive displacement transducer (1), which is transmitted on two channels electronic strain gauges (2), which are amplified and then placed in the oscillograph (3) for amplification and visualization (fig. 10 [5]). Use electronic strain gauges with two channels N-2321 and laboratory oscillograph S8-13.

The connecting of transducer to the electronic strain gauges made by plugs "transducers" of the two channels (located on back panel). The plugs "out" on the same panel used to connect the strain gauges at oscillograph. The signal force for vertical deviation is applied to the entry "YA" of oscillograph and the movements, for horizontal deviation, the entry "X".

The calibration is linking between displacement slipper and horizontal deviation of the spot light on the oscilloscope screen. On the oscilloscope screen will get the diagram of variation of force along the course of work, following the composition spot on the horizontal deviation (due to displacement slipper) with the vertical (due to force

change).

The strain gauges with two-channel N-2321 allows the simultaneous measurement (with resistive strain gauges or inductive sensing elements) of some size as: forces, couples, pressure, movement, etc. To connect the strain gauges will be used marks two input channels. The first channel will connect a semipunte consist of a resistive transducer and a transducer resistive compensation and second, an inductive displacement transducer. The strain gauges allows the adjustment phase of pilot voltage to measure, the adjustment phase of pilot voltage to capacitive balancing, the leverage adjustment, the choice of measurement scale, the balancing resistive thin, medium and gross, gross and fine balancing capacitive.

Oscilloscope S8-13 is equipped with an amplifier "Y" with two channels, working in 0.50 MHz bandwidth and has a sensitivity of 20 mV/division. The base time oscillograph has three work schemes: automatic, triggered, monotriggered. The oscillograph has two rectangular calibration signals of 1 kHz, for amplitude 120 mV and 1,2 V. Input signals can be connected directly by low-pass filter (10 kHz-2MHz) and high-pass filter (2MHz-50MHz).

3. Conclusion

The experimental stand proposed research, including press PAI 16, equipped with cell matrix with active elements quickly replaceable, strain gauges electronic two-channel N - 2321 and laboratory oscilloscope S8 - 13 necessary to measure the drawing force [4].

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INTEGRAL OPERATORS OF POTENTIAL TYPE

Vergil CHIȚAC¹

Dumitru Dan PASCALI²

¹Lecturer Ph.D, “Dimitrie Cantemir”, Faculty of Tourism and Commercial Management Constanta, Christian University Bucharest, Romania

²Full Professor Ph.D, Courant Institute of Mathematical Sciences New York University, USA

Abstract: In order to prove the Sobolev imbedding theorem we shall establish an integral representation of continuous differentiable functions and discuss some properties of integral operators with a polar Kernel.

Key Words: compact operators, integral operators, representation of integral operators

1. Introduction

The first attempts to solve nonlinear functional equations have involved different aspects of compactness. The fixed point theory has played a decisive role in this area. We consider that are satisfied the properties of compact maps in finite-dimensional cases and the operators of monotone type extend some of these properties to infinite-dimensional spaces. We collected and we used results well known results of compact operators, Sobolev imbeddings and the fixed point theory to give an integral representation of continuous differentiable functions and to put in discussions some properties of integral operators of potential type (with a polar type Kernel).

2. Linear integral operators

Let $\Omega \subset \mathbb{R}^N$ and $\Omega' \subset \mathbb{R}^N$ be two bounded domains with $N \geq N'$. If $k : \overline{\Omega} \times \Omega' \rightarrow \mathbb{R}$ is a continuous Kernel, then the linear map $u = Pv$ defined by:

$$u(x) = \int_{\Omega} k(x, y)v(y)dy \quad (1)$$

is a compact operator from $L^1(\Omega)$ into $C(\overline{\Omega'})$

The following theorem shows the conditions for the Kernel $k(x,y)$, which make P a mapping from $L^p(\Omega)$ into $L^q(\Omega')$.

Theorem 2.1. Suppose that there exist two numbers $s, t > 1$ with the following properties :

- (a) $\left(\int_{\Omega} |k(x, y)|^s dx \right)^{\frac{1}{s}} \leq c_1$ a.e. $y \in \Omega'$
- (b) $\left(\int_{\Omega} |k(x, y)|^t dy \right)^{\frac{1}{t}} \leq c_2$ a.e. $x \in \Omega$
- (c) $q \geq p, q \geq s$ and $\left(1 - \frac{s}{q}\right)p' < t$

Then P is a compact operator from $L^p(\Omega)$ into $L^q(\Omega')$ and $\|P\| \leq C_1^{\frac{s}{q}} C_2^{1 - \frac{s}{q}}$

If the third condition in (c) is weakened to become $\left(1 - \frac{s}{q}\right)p' \leq t$ then the operator $P : L^p(\Omega) \rightarrow L^q(\Omega')$ need not be compact but it is still continuous (for proof, see [1])

3. Integral operators of potential type

Let Ω be a bounded convex domain in \mathbb{R}^N of diameter δ and let $u \in C^1(\Omega)$. Then we have the representation

$$u(x) = \frac{1}{\mu(\Omega)} \int_{\Omega} u(y)dy - \int_{\Omega} \frac{k(x, y) \cdot \nabla u(y)}{|x - y|^{N-1}} dy \quad (2)$$

where $k : \Omega \times \Omega \rightarrow \mathbb{R}^N$ is bounded and continuous for $x, y \in \Omega, x \neq y$ and

$$|k(x, y)| \leq \frac{\delta^N}{\mu(\Omega)} \quad (3)$$

For any fixed $x \in \Omega$ we can describe other point $y \in \Omega$ by specifying the distance $R = |x - y|$ and the unit vector ρ directed from x to y such that $y = x + R\rho$. Then:

$$u(x) = u(y) - \int_0^R \frac{\partial u}{\partial \rho} d\rho \quad (4)$$

We will multiply this equality by $R^{N-1}dR$ and we will integrate it with respect to R between 0 and $d = d(\rho)$ from point x along the radius vector ρ , where $d(\rho)$ is the length in this direction within Ω . Thus,

$$u(x) \int_0^d R^{N-1} dR = \int_0^d u(y) R^{N-1} dR - \int_0^d R^{N-1} dR \int_0^R \frac{\partial u(y)}{\partial \rho} d\rho = \int_0^d u(y) R^{N-1} dR - \int_0^d \frac{\partial u(y)}{\partial \rho} \left(\int_0^d R^{N-1} dR \right) d\rho =$$

$$\int_0^d u(y) R^{N-1} dR - \int_0^d \frac{d^N - \rho^N}{N} \frac{\partial u(y)}{\partial \rho} \frac{1}{\rho^{N-1}} \rho^{N-1} d\rho$$

If we change the notation in the last integral by putting R instead of ρ and multiply both sides of the equality by the elementary solid angle $d\sigma$, which is the surface element of the unit sphere $S \subset \mathbb{R}^N$ and if we use the formula

$$\int_{\Omega} v(y) dy = \int_S d\sigma \int_0^d v(y) R^{N-1} dR \quad \text{we will obtain} \quad u(x) \mu(\Omega) = \int_{\Omega} u(y) dy - \int_{\Omega} \frac{d^N - R^N}{N} \frac{\partial u(y)}{\partial \rho} \frac{1}{R^{N-1}} dy$$

Since $\frac{u(y)}{\partial \rho} = \rho \nabla u$ we got the representation (2) with $k(x, y) = \frac{d^N - R^N}{N \mu(\Omega)} \rho$.

Among the consequences of this equality there are inequality (3) and the fact that $k(x, y)$ is continuous. We can investigate the representation (2) of integral operators of potential type

$$u(x) = \int_{\Omega} \frac{k(x, y)}{|x - y|^{\lambda}} v(y) dy, \quad \text{where } \lambda < N$$

This map defines a linear operator $u = P_{\lambda} v$ in $L^p(\Omega)$ with $p \geq 1$. Let p' be conjugate number of p. Then following theorem take place:

Theorem 3.1. If $\lambda < \frac{N}{p}$, the map $P_{\lambda} : L^p(\Omega) \rightarrow C(\overline{\Omega})$ is compact

Proof: Under the hypothesis:

$$|k(x, y)| \leq k, k > 0$$

$B(0, R) \equiv B$ a ball which contains Ω

$$r = |x - y|$$

Holder's inequality yields $|u(x)| \leq k \|v\|_p \left(\int_B r^{-\lambda p'} dy \right)^{\frac{1}{p}}$

In spherical coordinates with pole at x we have $dy = r^{N-1} dr d\sigma$ and

$$\int_B r^{-\lambda p'} dy \leq \int_0^{2R} r^{N-\lambda p'-1} dr \int_S d\sigma = \frac{|S|}{N - \lambda p'} (2R)^{N-\lambda p'} \quad (5)$$

Hence $|u(x)| \leq k \left(\frac{|S|}{N - \lambda p'} \right)^{\frac{1}{p}} (2R)^{\frac{N-\lambda}{p}} \|v\|_p$ and the boundedness of P is proved.

Using Arzela-Ascoli theorem it remains to prove the equi-continuity of all functions $u(x)$.

Let $\delta > 0$ and $\Omega_{\delta} = \{y \in R / |y - x| \geq \delta\}$

For $h \in R^n$ with $|h| < \frac{\delta}{2}$ and $x + h \in \Omega$ one has

$$|u(x+h) - u(x)| \leq \int_{\Omega_{\delta}} \left| \frac{k(x, y)}{|x - y|^{\lambda}} - \frac{k(x+h, y)}{|x+h - y|^{\lambda}} \right| |v(y)| dy + k \int_{\Omega - \Omega_{\delta}} \frac{|v(y)|}{|x - y|^{\lambda}} dy + k \int_{\Omega - \Omega_{\delta}} \frac{|v(y)|}{|x+h - y|^{\lambda}} dy$$

For each $\varepsilon > 0$ there exists a $\delta > 0$ such that the first integral is less than ε provided that $|h| \leq \eta$, by the continuity of

$k(x, y)$. For the others integrals we have $|x - y| \leq \delta$ and $|x+h - y| \leq \frac{3\delta}{2}$.

Applying the estimate (5) with $2r = \delta$ and $2R = \frac{3\delta}{2}$

$$|u(x+h) - u(x)| \leq \left\{ \varepsilon [\mu(\Omega)]^{\frac{1}{p}} + k \left(\frac{|S|}{N - \lambda p'} \right)^{\frac{1}{p}} \left[\delta^{\frac{N-\lambda}{p}} + \left(\frac{3\delta}{2} \right)^{\frac{N-\lambda}{p}} \right] \right\} \|v\|_p$$

Since the choice of ε and δ is arbitrary, the images $u = P_{\lambda} v$ are equi-continuous in $C(\overline{\Omega})$ and P_{λ} is compact.

For $\frac{N}{p} \leq \lambda < N$ we apply theorem 2.1 to integral operators of potential type. The integrability of the Kernel of P_λ , of power s

with respect to x and of power t with respect to y requires that $\lambda s < N'$ and $\lambda t < N$.

We may replace s and t by any number close to $\frac{N'}{\lambda}$ and $\frac{N}{\lambda}$ and the assumption (c) of theorem 2.1 becomes

$$1 - \frac{N'}{\lambda_q} p' < \frac{N}{\lambda}$$

Solving with respect to q and using $q \leq p$, we get $q < q^* = \frac{N' p}{N - (N - \lambda)p}$, $N' > N - (N - \lambda)p$ (6)

If $N - (N - \lambda)p = 0$ then the number q may be arbitrary. Hence we have the following proposition:

Proposition 3.2. Let $\frac{N}{p} \leq \lambda < N$. Suppose that the conditions given by (6) are fulfilled. Then the operator P_λ is compact

from $L^p(\Omega)$ into $L^q(\Omega')$, where Ω' is an N' -dimensional plane section of Ω , with $N' \leq N$.

The operator P_λ from $L^p(\Omega)$ into $L^{q^*}(\Omega')$ is at least continuous.

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THE MODALITY TO ESTABLISH THE INTEGRATION OF CHEMICAL ELEMENTS INTO GROUP A OR B OF THE PERIODIC SYSTEM

Florica CHIVU¹

¹ Asist. Univ. Dr. Chivu Florica, Academia Navala “Mircea cel Batran” Constanta

Abstract: *The modality to establish the integration of a chemical element into group A or B of the periodic system shall meet the following criteria:*

- *An element falls into group A of the periodic system if in its nucleus the last baryon has a spin 1/2;*
- *An element falls into group B of the periodic system if in its nucleus the last baryon has a spin 3/2;*

The baryonic spin criterion of the last baryon of a certain element makes it possible to establish that there are 50 elements falling into group A and 62 elements falling into group B, i.e. a total amount of 1/2 of the elements.

Key words: *baryonic spin, periodic system, chemical element.*

The classification of the periodic system elements has been regarded by over 4,000 scientists as “the most significant discovery in history”, the second most important after the discovery of iron.

The discovery of numerous chemical elements and their characteristics at the beginning of the 19th century led to the necessity to classify them.

The first classification attempts have been attributed to L.I. Thenard who classified elements according to the character of oxides. In 1829 Dobereiner discovered the existence of triads of similar elements. In 1862 A.E.B De Chancourtois gives a spiral classification of elements in order of their atomic weight.

After 3 years, J.A.R Newlands, recording elements in ascending order of their atomic masses, finds out that they can be divided into 7 groups of 8 elements each. In 1869 Mendeleev discovers due to an extraordinary intuition the law of periodicity, recalculates and corrects the atomic masses of a number of elements and leads the way for the discovery of elements he had envisaged. N. Bohr completes the periodic systemic with the group of rare gases noted with 0 as well as with the rest of the new elements.

In their book “The Five biggest Ideas in Science”, Charles M and W. Wiggins regard the discovery of the atom structure as the biggest idea.

In his book “Cosa sono e quanti sono gli elementi chimici”, Massimo Corbucci brings along an unheard of novelty in nuclear physics, thus upturning the importance of nuclear structure in establishing the integration of a chemical element into group A or B. The integration is established according to the “baryonic spin” criterion of the last baryon of the chemical element, that is:

- an element falls into group A of the periodic system if in its nucleus there is a “last baryon” with a spin 1/2 ;

- an element falls into group B of the periodic system if in its nucleus there is a “last baryon” with a spin 3/2.

This criterion makes it possible to establish the integration of elements into a group of a specified class.

Lanthanides and actinides are perfectly integrated into the sequence of the periodic system as never before, so that all actinides could be classified in class A while a part of the lanthanides are classified under class A (5) and a part under class B (9). Due to the baryonic spin criterion it can be definitely stated that there are 50 elements in of the periodic system in class A and 62 elements of the periodic system in class B.

| | | |
|--|-------------|----|
| Group A - a total of 50 chemical elements | metals | 21 |
| | nonmetals | 10 |
| | semimetals | 8 |
| | lanthanides | 5 |
| | noble gases | 6 |

| | | |
|--|-------------|----|
| Group B - a total of 62 chemical elements | metals | 33 |
| | nonmetals | 5 |
| | semimetals | 1 |
| | lanthanides | 9 |
| | actinide | 14 |

ELENCO DEGLI ELEMENTI CHIMICI DI "GRUPPO A"
a sinistra dei Gas Nobili (50 Elementi)

| | | | | | |
|--------|-----|-----------|--------|-----|----------|
| 1 A = | 1) | Idrogeno | 34 " = | 54) | Xenon |
| 2 " = | 2) | Elio | 35 " = | 55) | Cesio |
| 3 " = | 3) | Litio | 36 " = | 56) | Bario |
| 4 " = | 4) | Berillio | 37 " = | 67) | Olmio |
| 5 " = | 5) | Boro | 38 " = | 68) | Erbio |
| 6 " = | 6) | Carbonio | 39 " = | 69) | Tulio |
| 7 " = | 7) | Azoto | 40 " = | 70) | Ytterbio |
| 8 " = | 8) | Ossigeno | 41 " = | 71) | Lutezio |
| 9 " = | 9) | Fluoro | 42 " = | 81) | Tallio |
| 10 " = | 10) | Neon | 43 " = | 82) | Piombo |
| 11 " = | 11) | Sodio | 44 " = | 83) | Bismuto |
| 12 " = | 12) | Magnesio | 45 " = | 84) | Polonio |
| 13 " = | 13) | Alluminio | 46 " = | 85) | Astato |
| 14 " = | 14) | Silicio | 47 " = | 86) | Radon |
| 15 " = | 15) | Fosforo | 48 " = | 87) | Francio |
| 16 " = | 16) | Zolfo | 49 " = | 88) | Radio |
| 17 " = | 17) | Cloro | 50 " = | 89) | Attinio |
| 18 " = | 18) | Argon | | | |
| 19 " = | 19) | Potassio | | | |
| 20 " = | 20) | Calcio | | | |
| 21 " = | 31) | Gallio | | | |
| 22 " = | 32) | Germanio | | | |
| 23 " = | 33) | Arsenico | | | |
| 24 " = | 34) | Selenio | | | |
| 25 " = | 35) | Bromo | | | |
| 26 " = | 36) | Krypton | | | |
| 27 " = | 37) | Rubidio | | | |
| 28 " = | 38) | Stronzio | | | |
| 29 " = | 49) | Indio | | | |
| 30 " = | 50) | Stagno | | | |
| 31 " = | 51) | Antimonio | | | |
| 32 " = | 52) | Tellurio | | | |
| 33 " = | 53) | Iodio | | | |

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Picture 1

Picture 2

**ELENCO DEGLI ELEMENTI CHIMICI DI “GRUPPO B”
a destra dei Gas Nobili (62 Elementi)**

| | | | | | |
|-------------------|-----|-------------|--------|------|--------------|
| 1 ^a = | 21) | Scandio | 34 “ = | 75) | Renio |
| 2 ^a = | 22) | Titanio | 35 “ = | 76) | Osmio |
| 3 ^a = | 23) | Vanadio | 36 “ = | 77) | Iridio |
| 4 ^a = | 24) | Cromo | 37 “ = | 78) | Platino |
| 5 ^a = | 25) | Manganese | 38 “ = | 79) | Oro |
| 6 ^a = | 26) | Ferro | 39 “ = | 80) | Mercurio |
| 7 ^a = | 27) | Cobalto | 40 “ = | 90) | Torio |
| 8 ^a = | 28) | Nichel | 41 “ = | 91) | Protoattinio |
| 9 ^a = | 29) | Rame | 42 “ = | 92) | Uranio |
| 10 ^a = | 30) | Zinco | 43 “ = | 93) | Nettunio |
| 11 ^a = | 39) | Ittrio | 44 “ = | 94) | Plutonio |
| 12 ^a = | 40) | Zirconio | 45 “ = | 95) | Americio |
| 13 ^a = | 41) | Niobio | 46 “ = | 96) | Curio |
| 14 ^a = | 42) | Molibdeno | 47 “ = | 97) | Berkelio |
| 15 ^a = | 43) | Tecnecio | 48 “ = | 98) | Californio |
| 16 ^a = | 44) | Rutenio | 49 “ = | 99) | Einsteinio |
| 17 ^a = | 45) | Rodio | 50 “ = | 100) | Fermio |
| 18 ^a = | 46) | Palladio | 51 “ = | 101) | Mendelevio |
| 19 ^a = | 47) | Argento | 52 “ = | 102) | Nobelio |
| 20 ^a = | 48) | Cadmio | 53 “ = | 103) | Laurenzio |
| 21 ^a = | 57) | Lantanio | 54 “ = | 104) | Rutherfordio |
| 22 ^a = | 58) | Cerio | 55 “ = | 105) | Dubnio |
| 23 ^a = | 59) | Praseodimio | 56 “ = | 106) | Seaborgio |
| 24 ^a = | 60) | Neodimio | 57 “ = | 107) | Bohrio |
| 25 ^a = | 61) | Promezio | 58 “ = | 108) | Hassio |
| 26 ^a = | 62) | Samario | 59 “ = | 109) | Meitnerio |
| 27 ^a = | 63) | Europio | 60 “ = | 110) | Darmstadio |
| 28 ^a = | 64) | Gadolinio | 61 “ = | 111) | Rontgenio |
| 29 ^a = | 65) | Terbio | 62 “ = | 112) | Viterbio |
| 30 ^a = | 66) | Disprosio | | | |
| 31 ^a = | 72) | Hafnio | | | |
| 32 ^a = | 73) | Tantalio | | | |
| 33 ^a = | 74) | Tungsteno | | | |

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ABOUT THE CONJUGATION OF MAXIMAL TORAL SUBALGEBRAS FOR A SEMISIMPLE LIE ALGEBRA

Camelia CIOBANU¹

Cristina FLAUT²

Diana SAVIN³

¹ Ass. Prof., Dept. of Mathematics-Informatics and Fundamental Technical Sciences, “Mircea cel Batran” Naval

² Lect., Dept. of Mathematics and Informatics, “Ovidius” University, Constanta, Romania

³ Lect., Dept. of Mathematics and Informatics, “Ovidius” University, Constanta, Romania

Abstract: We shall prove in this paper that the root system associated to a semisimple Lie algebra does not depend on the maximal toral subalgebra considered. This will follow from the fact that two maximal toral subalgebras are conjugated via an automorphism of Lie algebra.

Keywords: semisimple Lie algebra, toral subalgebra, Cartan decomposition.

MSC2000: Primary 17B20; Secondary 17B05.

1. Preliminaries

We start by recalling some elementary notions regarding integral extensions of rings. All rings considered are commutative and unitary. For more details, the reader can consult for instance [1] and [2].

Definition 1.1 Let B be an A -algebra and $x \in B$. We say that x is integral over A iff x is the root of a monic polynomial with coefficients in A .

Proposition 1.2 Let B be an A -algebra and $x \in B$. The following assertions are equivalent:

x is an integral over A .

the A -module $A[x]$ is finitely generated.

$\exists M$, a finitely generated and faithful (i.e. its annihilator is zero) A -submodule of B , such that $xM \subseteq M$.

Proof: 1) \Rightarrow 2). If n is the degree of the polynomial annihilated by x , then $A[x]$ is generated by $1, x, \dots, x^{n-1}$.

2) \Rightarrow 3). Take $M = A[x]$.

3) \Rightarrow 1). Let $\{m_1, \dots, m_n\}$ be a system of generators for M . Writing, for every i , $xm_i = \sum_j a_{ij}m_j$ and denoting

by $d = \det(x \cdot I - (a_{ij}))$ we get $dM = 0$. Since M is faithful, it follows that $d = 0$, which provides the required relation of integral dependence for x .

Corollary 1.3 $A'_B := \{x \in B \mid x \text{ integral over } A\}$ is a subring of B .

Proof: $M = A[x, y]$ is a finitely generated faithful A -module, $(x-y)M \subseteq M$ and $xyM \subseteq M$.

Definition 1.4 A ring morphism $A \rightarrow B$ is called:

integral, iff x is integral over A , $\forall x \in B$

of finite type, iff B finitely generated as an A -algebra, and

finite, iff B is finitely generated as an A -module.

If $A \subset B$ is a ring extension, we say that A is integrally closed in B iff $A'_B = A$. A domain A is called integrally closed

iff is integrally closed in its field of fractions, denoted by $A_{(0)}$.

Proposition 1.5 i) A morphism is finite \Leftrightarrow it is integral and of finite type.

ii) If $A \subset B$ is an integral extension, and $I \triangleleft A$, $I \neq A$, then $IB \neq B$ (in particular, if B is a field, then so is A).

iii) If $A \subset B$ is an integral extension, and $J \triangleleft B$, $J \neq 0$, then $J \cap A \neq 0$.

Proof: i) is clear by Proposition 1.2, 1) \Rightarrow 2, and for (\Leftarrow) we take $M = B$ in Proposition 1.2, 3) \Rightarrow 1).

ii) Let $\{b_1, \dots, b_k\}$ be a system of generators for B as an A -module. If $B = IB$, then put, for every i , $b_i = \sum_{j=1}^k a_{ij}b_j$,

$a_{ij} \in I$. If $d = \det(1 \cdot I - (a_{ij}))$, then d kills all the b_i 's, so $d \cdot 1_B = 0$, hence $d = 0$, and thus $1 \in I$, a contradiction.

iii) Let $0 \neq x \in J$. Let $x^m + \dots + a_1 x + a_0 = 0$ be a relation of integral dependence of x over A , with minimal m . It follows that $a_0 \neq 0$, and that $a_0 \in J \cap A$.

Lemma 1.6 Let $A \subset B = A[x_1, \dots, x_n]$, A a domain. If x_1, \dots, x_n are algebraic over $A_{(0)}$, then there exists an $f \in A$ such that the extension $A_f \subset B_f = A_f[x_1, \dots, x_n]$ is integral. Moreover, any multiple of f has the same property. (We have denoted by A_f the ring of fractions of A with respect to the multiplicative set formed with the powers of f .)

Proof: Take f to be the product of all denominators of the coefficients of polynomials killing x_1, \dots, x_n . It follows that all of them become integral over A_f . The extension is finite, hence integral.

THEOREM 1.7 (Nullstellensatz, Hilbert)[1] If F is algebraically closed, then the only maximal ideals of the polynomial ring $F[T_1, \dots, T_n]$ are those of the form $(T_1 - a_1, \dots, T_n - a_n)$.

Proof: (Zariski) Let \underline{m} be a maximal ideal. Thus

$$\frac{F[T_1, \dots, T_n]}{\underline{m}} = F[x_1, \dots, x_n],$$

which is a field. If we show that the extension $F[x_1, \dots, x_n] \supset F$ is algebraic, it will follow that $F = F[x_1, \dots, x_n]$, so

$x_i = \hat{T}_i = a_i \in F \forall i$, hence $T_i - a_i \in \underline{m}, \forall i$, and thus

$(T_1 - a_1, \dots, T_n - a_n) \subseteq \underline{m}$. Since both of them are maximal ideals, equality follows.

We show that the extension is algebraic by induction on n . If $n=1$ this is clear (if x would be transcendental, then we would have $F[x] \cong F[T]$, which is not a field).

Assume that the assertion is true for $n-1$ and obtain

$$F[x_1, \dots, x_n] = F[x_1][x_2, \dots, x_n] = F(x_1)[x_2, \dots, x_n] \supset F(x_1),$$

which is an algebraic extension by the induction hypothesis. By Lemma 1.6 we get that there exists an $f \in F[x_1]$ such that the extension $F[x_1, \dots, x_n] \supset F[x_1]_f$ is integral. If we show that x_1 is algebraic, then we have finished. Suppose for a moment that x_1 is transcendental and look for a contradiction. We have $F[x_1] \cong F[T]$, which is factorial. It follows that $F[x_1]_f$ is factorial, hence integrally closed. We obtain that $F[x_1]_f = F(x_1)$, which is a contradiction, since $F[x_1]_f$ is not a field.

Definition 1.8 (The Zariski topology)[6] In F^n , the sets of the form

$$V(I) = \{(x_1, \dots, x_n) \mid P(x_1, \dots, x_n) = 0 \forall P \in I\},$$

$(I \triangleleft F[T_1, \dots, T_n])$ satisfy the axioms of closed sets in a topology. We have clearly that $V(F[T_1, \dots, T_n]) = \emptyset$, and $V(0) = F^n$. We note that V may be defined for arbitrary subsets of $F[T_1, \dots, T_n]$, but V applied to a subset coincides with V applied to the ideal generated by that subset.

An open set of the form $D(f) = F^n \setminus V(f)$ is called a principal open set. We have $D(f) \cap D(g) = D(fg)$, and the principal open sets form a basis for the Zariski topology, since we have, for $\forall I \triangleleft F[T_1, \dots, T_n]$, and $\forall f \in I, D(f) \subseteq F^n \setminus V(I)$.

Definition 1.9 A map $P: F^n \rightarrow F^n$ is called a polynomial map iff there exist $P_1, \dots, P_n \in F[T_1, \dots, T_n]$, such that

$$P(x) = P(x_1, \dots, x_n) = (P_1(x_1, \dots, x_n), \dots, P_n(x_1, \dots, x_n)).$$

The differential of P in a point $v \in F^n$ is the linear map defined by

$$(d_v P)(x) = \left(\sum_{i=1}^n \left(\frac{\partial P_1}{\partial T_i} \right)_v x_i, \dots, \sum_{i=1}^n \left(\frac{\partial P_n}{\partial T_i} \right)_v x_i \right).$$

The differential of P in v is thus the linear map which in the canonical basis has the matrix $\left(\left(\frac{\partial P_i}{\partial T_j} \right)_v \right)$, called the Jacobi matrix.

Another interpretation of the differential is the following: it is the homogenous part of degree 1 (in the x's) from the Taylor series $P(x+v) - P(v)$.

If P is a polynomial map, we shall denote by

$$P^* : F[T_1, \dots, T_n] \rightarrow F[T_1, \dots, T_n],$$

$P^*(Q) = Q(P_1, \dots, P_n)$, the unique ring morphism sending T_i to P_i .

Proposition 1.10 If $\exists v \in F^n$ such that the matrix $\left(\left(\frac{\partial P_i}{\partial T_j} \right)_v \right)$ is nonsingular, then P^* is injective.

Proof: Let $Q(P_1, \dots, P_n) = 0$. We want to show that $Q = 0$. If Q is constant, then this is clear. If not, then for every i we have

$$\frac{\partial}{\partial T_j} Q(P_1, \dots, P_n) = 0,$$

and we obtain

$$\sum_j \left(\frac{\partial Q}{\partial T_j} \right) (P_1, \dots, P_n) \cdot \frac{\partial P_j}{\partial T_i} = 0. \quad (1)$$

Computing (1) in v, we get a homogenous system with nonzero determinat, thus

$$\left(\left(\frac{\partial Q}{\partial T_j} \right) (P_1, \dots, P_n) \right) (v) = 0 \quad \forall j \quad (2)$$

Let us derivate again in (1) to obtain that for every i

$$\sum_{j,k} \left(\frac{\partial^2 Q}{\partial T_k \partial T_j} \right) (P_1, \dots, P_n) \cdot \frac{\partial P_k}{\partial T_s} \frac{\partial P_j}{\partial T_i} + \sum_j \left(\frac{\partial Q}{\partial T_j} \right) (P_1, \dots, P_n) \cdot \frac{\partial^2 P_j}{\partial T_s \partial T_i} = 0. \quad (3)$$

Computing (3) in v, and taking (2) into account, we obtain, also from a homogenous system with nonzero determinant, that

$$\sum_{j,k} \left(\frac{\partial^2 Q}{\partial T_k \partial T_j} \right) (P_1, \dots, P_n) (v) = 0 \quad \forall j, k \quad (4)$$

We derivate again in (3), we compute in v, we use (2) and (4), etc. We keep going until we obtain

$$(1(P_1, \dots, P_n))(v) = 0,$$

which is the desired contradiction.

Proposition 1.11 If the polynomial map $P: F^n \rightarrow F^n$ has the property that P^* is injective, then the image via P of any open set contains an open set.

Proof: We first show that $\text{Im}(P)$ contains an open set. We denote by

$$\text{Im}(P^*) = A \subset B = F[T_1, \dots, T_n].$$

As A and B have the same field of fractions, we apply Lemma 1.6, which asserts the existence of a $P^*(f) \in A$ such that the extension $A_{P^*(f)} \subset B_{P^*(f)}$ is integral. We clearly have that $P(D(P^*(f))) \subseteq D(f)$ (because if $P^*(f(x_1, \dots, x_n)) \neq 0$, then

$f(x_1, \dots, x_n) \neq 0$). We show that quality holds here. We have

$$F[T_1, \dots, T_n]_f \cong A_{P^*(f)},$$

(via P^*) and we denote also by P^*

$$F[T_1, \dots, T_n]_f \cong \frac{F[T_1, \dots, T_n, T_{n+1}]}{(T_{n+1}f - 1)} \xrightarrow{P^*} \frac{F[T_1, \dots, T_n, T_{n+1}]}{(T_{n+1}P^*(f) - 1)} \cong B_{P^*(f)}.$$

Let $(y_1, \dots, y_n) \in D(f)$. Then

$$(T_{n+1}f - 1) \subset (T_1 - y_1, \dots, T_n - y_n, T_{n+1} - \frac{1}{f(y_1, \dots, y_n)}).$$

Indeed, from

$$f = f_1 \cdot (T_1 - y_1) + \dots + f_n \cdot (T_n - y_n) + f(y_1, \dots, y_n)$$

it follows that

$$T_{n+1}f - 1 = f_1' \cdot (T_1 - y_1) + \dots + f_n' \cdot (T_n - y_n) + f(y_1, \dots, y_n)(T_{n+1} - \frac{1}{f(y_1, \dots, y_n)}).$$

The ideal

$$\frac{(T_1 - y_1, \dots, T_n - y_n, T_{n+1} - \frac{1}{f(y_1, \dots, y_n)})}{(T_{n+1}f - 1)}$$

is maximal. Since the extension is integral, from Proposition 1.5 ii) it follows that its extension is a proper ideal. It is thus contained in a maximal ideal, which by Theorem 1.7 is of the form

$$\frac{(T_1 - x_1, \dots, T_n - x_n, T_{n+1} - x_{n+1})}{(T_{n+1}P^*(f) - 1)}$$

It follows (regarding again the rings in the extension as rings of fractions) that

$$P_i - y_i \in (T_1 - x_1, \dots, T_n - x_n), \quad \forall i,$$

thus $P_i(x_1, \dots, x_n) = y_i, \quad \forall i$, hence

$$0 \neq f(y_1, \dots, y_n) = f(P_1(x_1, \dots, x_n), \dots, P_n(x_1, \dots, x_n)) = P^*(f)(x_1, \dots, x_n),$$

$$\text{and } (y_1, \dots, y_n) = P(x_1, \dots, x_n).$$

It remains to prove that the image of any open set contains an open set. We can clearly restrict ourselves to principal open sets. Let $0 \neq g \in B$, and $g' \neq 0$ such that $D(g) \supseteq D(P^*(g'))$ (see Proposition 1.5 iii)). We have

$$\begin{aligned} P(D(g)) &\supseteq P(D(P^*(g'))) \supseteq P(D(P^*(g'))) \cap P(D(P^*(f))) \supseteq \\ &\supseteq P(D(P^*(g')) \cap D(P^*(f))) = P(D(P^*(g')P^*(f))) = P(D(P^*(g'f))) = D(g'f) \end{aligned}$$

(we have used the remark from Lemma 1.6 that any multiple of f is good).

2. The conjugation Theorem

With roots in the nineteenth century, Lie theory has since found many and varied applications in mathematics and mathematical physics, to the point where it is now regarded as a classical branch of mathematics in its own right. We can see for this, many works (see for this [3], [5], [7], [8], [9]).

In this section we shall present another form of conjugation's theorem and its proof. Books like: [4], [6], [10] shows various forms of the conjugation's theorem, but in this article we attempt a more accurate form of this result for semisimple Lie algebras. Let L be a simple Lie algebra, H a toral maximal subalgebra of L , i.e., a toral subalgebra not properly included in any other, and

$$L = H \oplus \bigoplus_{\alpha \in \Phi} L_\alpha$$

the Cartan decomposition.

We note by L_α the set $L_\alpha = \{x \in L \mid [h, x] = \alpha(h)x \text{ for all } h \in H\}$ where α ranges over H' . The set of all nonzero $\alpha \in H'$ for which $L_\alpha \neq 0$ is denoted by Φ ; the elements of Φ are called the roots of L relative to H .

Definition 2.1 An element $h \in H$ with the property that $\alpha(h) \neq 0, \quad \forall \alpha \in \Phi$, is called regular. We denote by

$$H_{reg} = \{h \in H \mid h \text{ is regular}\}.$$

H_{reg} is clearly an open set in the Zariski topology (its complement is a union of hyperplanes).

We show now that every regular element determines the Cartan subalgebra:

Lemma 2.2 For any $h \in H_{reg}$ we have that

$$H = C_L(H) = C(H) = \{x \in L \mid [x, h] = 0\}.$$

Proof: The inclusion \subseteq is obvious. Conversely, let $x \in C(h)$. We want to show that $[x, h'] = 0, \forall h' \in H$. Write

$$x = x_0 + \sum_{\alpha \in \Phi} x_\alpha, \quad x_0 \in H, \quad x_\alpha \in L_\alpha.$$

Then $0 = [h, x] = [h, x_0 + \sum x_\alpha] = \sum \alpha(h)x_\alpha$, (we used the fact that H is abelian and the definition of L_α).

Since all $\alpha(h)$ are nonzero, we get that all $x_\alpha = 0$ (they are linearly independent). It follows that $x = x_0 \in H$, so $[x, h'] = 0$.

Theorem 2.3 *If L is semisimple Lie algebra, and H and H' are maximal toral subalgebras, then H and H' are conjugated via an automorphism of L .*

Proof: Let H be a maximal toral subalgebra. Denote the roots by $\Phi = \{\alpha_1, \dots, \alpha_r\}$, and consider the following map

$$F_H : L \rightarrow L, \quad F_H(h, x_1, \dots, x_r) = \exp(\text{ad } x_1) \dots \exp(\text{ad } x_r)(h)$$

(here $h \in H$ and $x_i \in L_{\alpha_i}$, and so $\text{ad } x_i$ is nilpotent, thus $\exp(\text{ad } x_i) \in \text{Aut}(L)$).

If we show that the image of $H \text{ reg} \times L_{\alpha_1} \times \dots \times L_{\alpha_r}$ via F_H intersects the image of the corresponding set via $F_{H'}$ for some other toral maximal subalgebra H' , then we are done. Indeed, this would mean there exist $h \in H_{\text{reg}}$ and $h' \in H'_{\text{reg}}, \Gamma, \Gamma' \in \text{Aut}(L)$, such that $\Gamma(h) = \Gamma'(h')$. Since it is immediate to see that $\Gamma(C(h)) = C(\Gamma(h))$, then we have $\Gamma(H) = \Gamma(C(h)) = C(\Gamma(h)) = C(\Gamma'(h')) = \Gamma'(C(h')) = \Gamma'(H')$, so $X = \Gamma^{-1} \Gamma'(H')$.

We shall apply Proposition 1.11 to the map F_H . We use Proposition 1.10, so we compute the differential of F_H in a point $(h_0, 0, \dots, 0)$ (h_0 regular). We have $F_H(h+h_0, x_1, \dots, x_r) - F_H(h_0, 0, \dots, 0) =$

$$= \sum_{k_1, \dots, k_r} \frac{1}{k_1} \dots \frac{1}{k_r} [x_1^{k_1} [\dots [x_r^{k_r}, h+h_0] \dots]] - h_0,$$

so $(dF_H)_{(h_0, 0, \dots, 0)}(h, x_1, \dots, x_r) = h + \sum [x_i h_0] = h + \sum \alpha_i(h_0)x_i$. If this is zero, then since h_0 is regular, it follows

that $h = 0$ and all $x_i = 0$. Consequently, $(dF_H)_{(h_0, 0, \dots, 0)}$ is injective, and the proof is complete.

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THE INFLUENTS OF COLD PLASTIC DEFORMATIONS OVER FRICTION COEFFICIENT AND MICROHARDNESS

Dumitru DASCĂLU¹
Draguta DASCALU²

¹ Dumitru DASCALU, Assoc. prof. Ph.D, Navy Academy “Mircea cel Batran” Constanta, Romania

² Draguta DASCALU**, mat. Prof. Scool number 5, Constanta

Abstract: *FINPLAST* it's the name of new experimental technology, propose by author for upgrading performance of the sliding bearings. This paper presents experimental determinations effect of **finplast** technology over hardness and friction coefficient. It is studying the influents of **finplast** parameters (cold plastic deformation force, the number of passes, the existence or not existence of lubrication during cold plastic deformations) and antifriction materials. It is presenting the value of the most important tribological parameters.

Key works: sliding bearings, technology, micro hardness, friction coefficient.

1. GENERALITIES

The author proposes for finishing the surfaces of antifriction layer the cold plastic deformation technology. For this new technology, the author proposed the name **finplast** [1]. The surfaces for experimental determinations are obtained using a wheel which acts with a controlled force over the plain surface with different parameters for study its effects. The most important parameters are cold plastic deformation force F;

- the number of passes n;
- the existence or not existence of lubricating oil during cold plastic deformations
- antifriction alloys.

For study, we accomplished on the plane surfaces a small experimental surface. For an easy identification this surfaces are marked with an identification code. The plane surfaces for first alloys, AlSn10, are obtained by convert by plastic deformations on plane surface from OL37. The identification code contains letter A and different numbers for every experimental surfaces. The plane surfaces for second alloy, CuPb5, is obtained by worm sintering alloys on plane surface from OL37, an adders material with large importance in construction of sliding bearings. The identification code for this alloy contains letter B and different numbers for every experimental surface. First, all experimental surfaces were manufactured by frontal turnery with the same parameters, and after, obtain the small surfaces finished by FINPLAST technology, with different parameters and conditions, like in table 1. To obtain these small surfaces, the author designs a special device. Table 1 shows every surface, using cold plastic deformation parameters.

2. STUDY OF THE INFLUENCE OF FINPLAST TECHNOLOGY OVER FRICTION COEFFICIENT

In order to experimental determine the friction coefficient, we used the very determinately tribometer, in the **laboratory Technique of invention and tribology**, of, TRANSILVANIA UNIVERSITY”, Brasov, Romania. This friction coefficient was determinate out of dry lubrication.

2.1. Study of dry friction coefficient for AlSn10

The experimental values of friction coefficient for AlSn10 are shown in the last column of table 1. To compare the effect of finplast technology, in the last rows of table 1 is shown the value of friction coefficient for surfaces obtained after turnery for AlSn10.

Table1. Experimental value of friction coefficient μ after FINPLAST for AlSn10

| Identification code | Cold plastic deformation force F [daN] | Nr. of passes n | Existence or not existence of oil | Friction coefficient μ |
|---------------------|--|-----------------|-----------------------------------|----------------------------|
| A.1. | 248.2 | 1 | No | 0.28940 |
| A.2. | 248.2 | 2 | No | 0.318497 |
| A.3. | 248.2 | 1 | Yes | 0.30779 |
| A.4. | 248.2 | 2 | Yes | 0.2738 |
| A.5. | 248.2 | 3 | Yes | 0.2805 |
| A.6. | 328.5 | 1 | Yes | 0.23253 |
| A.7. | 328.5 | 1 | No | 0.25097 |
| A.8. | 456.2 | 1 | Yes | 0.26985 |
| A.9. | 143 | 5 | No | 0.34644 |
| A.10. | 143 | 5 | Yes | 0.33723 |
| A.11. | 77.5 | 1 | Yes | 0.29299 |
| standard | | | | 0.28575 |

All these values are presented in table 1. For every surface were experimental determinate ten values of friction coefficient and with **Chuvonet** and **Charlier** method, select average value. For beginning we will study, for this alloy, the effect of variation of friction force for a single passing . To accentuate the effect of increasing of finishing force, we will analyze the values from Table 1, for a single passing case (n=1), in the presence of lubricating oil. From Table 1 we selected these values and for an easier explanation in fig. 1 we graphically present the respective values of the friction coefficient μ .

Analyzing the diagram can be observed an interesting thing: the minimum value of the friction coefficient corresponds to a cold finishing force of 328,5daN. Comparing with the value of friction coefficient μ of the standard surface obtained by

turning in the lathe machine, can be noticed that, the increase of F will increase μ . For higher values of finishing force, the friction coefficient will decrease below the standard surface values.

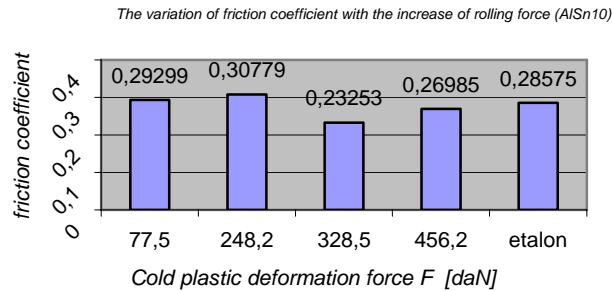


Fig.1

When the finishing it's without lubrication, comparing the values of friction coefficient μ for the tests A.1. with A.7., the lower value corresponds to the same value of 328.5daN of the finishing force.

In order to study the effect of number of passes on the friction coefficient μ , from Table 1 we select the values corresponding to tests A.3; A.4; and A.5. For these tests we kept the same cold plastic deformation force (248,5daN). In order to compare the results, these values were shown in Figure 2.

In Fig. 2 we can notice that the optimum value is obtained for $n=2$ (A.4). Also, from the value point of view can be noticed that the influence of number of passes n is higher than the one corresponding to the increasing of the values of the cold plastic deformation force. Both for $n=2$ and for $n=3$, the friction coefficient is lower than the value for a high number of passes $n=5$, but acting with a lower finishing force F , can be noticed a high increase of friction coefficient corresponding to the standard (etalon) value.

If we comparing the tests A.9 and A.10., for a high number of passes $n=5$, and applying a finishing force F lower, can be noticed a high increase of value of friction coefficient.

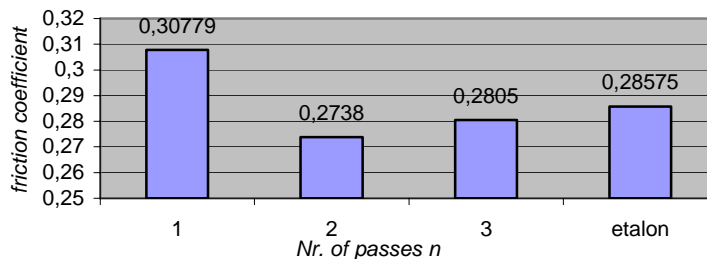


fig.2. The variation of friction coefficient

In order to evaluate the effect of lubricating oil on the contact surface in both cases, with, and respectively without lubrication, during finishing of surface by cold plastic deformation technology, we carried out a smaller number of tests but for a higher number of values of cold plastic deformation force.

Modifying the cold plastic deformation force F and the number of passes n , four pairs of tests have been carried out. According to the values from Table 1, for the same cold plastic deformation force F and number of passes $n=1$, for tests A.1. and A.3., μ presents an increase when lubrication is present. If we keep the same cold plastic deformation force but we carry out 2 passes (A.2 with A.4.), μ has a significant decrease in this situation with lubrication. An interesting situation is if we compare the effect of increasing the number of passes without lubrication (A.1 with A.2) and with lubrication (A.3 with A.4), we can notice that the effects are opposite. In first case can be noticed an increase of μ with the increase of n , and in second case a decrease. From the value point of view, this decrease of μ , is approximately equal with the increase from the first case.

Another pair of values is for tests A.7 and A.6., when the friction coefficient is minim. For the same cold plastic deformation force of 328.5 and the same number of passes $n=1$, the friction coefficient is significantly decreased by the presence of the lubricant.

If are compared the tests A.9. and A.10., for a higher number of passes ($n=5$) and a lower force F , the influence of lubrication on the value of friction coefficient is lower. The author considered useful to observe the effect of finishing when we determine the wet friction coefficient. For comparison, in Table 2 are shown the values of dry and respectively wet friction coefficient, for tests A.9. and A.10.. Conclusion, the wet friction coefficient shows a significant reduction when getting close to the standard (etalon) value.

Table2. The values of dry, respective wet friction coefficient

| Test code | μ (dry) | μ (with lubrication) |
|-----------|-------------|--------------------------|
| 1.9. | 0.34644 | 0.2846 |
| 1.10. | 0.33723 | 0.2929 |

2.2. CONCLUSIONS

- For AlSn10 alloy, in order to decrease μ , the lubrication during finishing has positive effects regardless of the other parameters.
- Generally speaking, if the finishing forces increases, for μ , the effect is positive. Observation μ has a minimum value for an intermediate value of the finishing force.
- The increase of n is not useful. The influence of the number of passes on the friction coefficient has to be correlative with the value of finishing force. For $n=5$, friction coefficient is much higher than the etalon value.
- The minimum value of friction coefficient is obtained for test A.6. ($n=1$, $F=328,5$ and with lubrication).
- The maximum value of the friction coefficient is obtained for test A.9. ($n=5$, $F=143$ and without lubrication).
- Wet friction coefficient shows a significant decrease when is getting close to the etalon value.

2.3. Study of friction coefficient for CuPb5

For the second studied material (B), CuPb5 sintered alloy, the results of the experiments are shown in table 3. in order to study the influence of material on friction coefficient after finplast finishing, the same values of finishing force F have been used. For comparison, as for the first material A, a few tests have been carried out for the surface obtained by lathe turning, without being finished by finplast technology.

In order to evaluate the influence of finishing force F , tests B.1, B.2, B.5. have been carried out. In all these cases only one pass was done ($n=1$). In Figure 3 is shown the variation diagram of $\mu = \mu(F)$. For comparison, near these values, also the value of the friction coefficient for the surface considered as etalon (standard) obtain by turning is shown. According to the diagram, an interesting thing is noticed.

Regardless the value of the force, the friction coefficient increases, which is not desirable. Over, for low forces, the effect of increase is insignificant. Instead, when passing from a force of 77.5daN to 248.5daN the increase is accentuated.

Table3. The experimental values of friction coefficient for alloy CuPb5

| Identificati on code | Finishin g Force [daN] | Number of passes n | With / without lubricati on | Friction coefficient μ |
|----------------------|------------------------|--------------------|-----------------------------|----------------------------|
| B.1 | 77.5 | 1 | No | 0.1976 |
| B.2. | 248.2 | 1 | No | 0.2269 |
| B.3. | 248.2 | 2 | No | 0.2318 |
| B.4. | 248.2 | 3 | No | 0.2101 |
| B.5. | 328.5 | 1 | Yes | 0.2152 |
| B.6. | 328.5 | 2 | Yes | 0.2101 |
| Etalon | | | | 0.19464 |

By comparing B.2 and B.5. can be noticed that, although the finishing force has risen due to the existence of lubricant during finishing, the friction coefficient will decrease.

For evaluated the effect of number of passes ($\mu = \mu(n)$) tests B.2, B.3, B.4. were carried out of. In this case the same force of 248.2daN had been applied, resulting in increasing the number of passes when lack of lubricant.

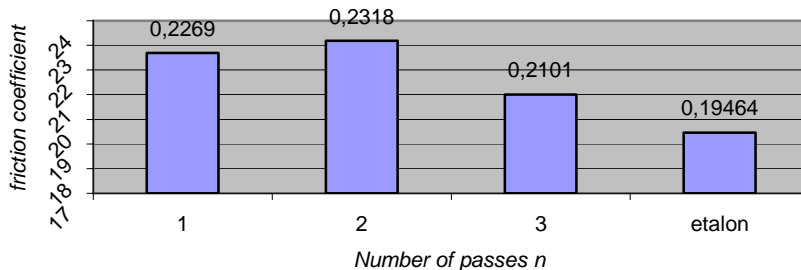


Fig.4 Variation of the friction coefficient with number of passes (CuPb5)

Comparing the value of μ corresponding to the etalon surface with the ones for the surfaces finished by cold plastic deformation technology, this will be minimum as well. Again is confirmed that for this material the friction coefficient increases, therefore the technology is not advantageous.

According to the diagram from Figure 4, can be noticed a tendency of decrease of μ when the number of passes n increases. The value obtained for $n=3$ is getting close to the etalon value. If analyze tests B.5 and B.6. we can observe that for the same force and when finishing with lubricant the number of passes doesn't have any influence.

2.4. Conclusions

- For CuPb5 alloy, finplast technology increases the value of friction coefficient with relatively low values. According to this criterion the method is not advantageous.
- According to table 3, for CuPb5 alloy, the presence or the lack of lubricant, the increase of finishing force and of number of passes have small influence on the friction coefficient.
- Regardless the parameters of finplast technology used, the friction coefficient has an increase of its value.
- Also have to be evaluated other tribological aspects.

3. THE INFLUENTS OF FINPLAST OVER HARDNESS OF ANTIFRICTION ALLOYS

It is known the fact that the hardness of the antifriction layer of the multilayer bush bearings is hard to be presented. Due to the fact that in both cases the antifriction alloy is on the same base manufactured from OL37, the errors are comparable for all the tests done. For alloy A (AlSn10) we carried out the Vichers hardness (HV10). For the second alloy B (CuPb5) laid-down by warm sintering, considering it's proprieties we determined Brinell hardness (HB/2,5/31,5).

Same as for determination of friction coefficient, in order to be able to evaluate the way the material influences the hardness of antifriction layer obtained by finplast technology proposed by the author, for both materials have been used same values of force as for the first material A.

3.1. The study of the effect of finishing by finplast technology on the hardness of antifriction layer for AlSn10 alloy

The values of HV10 hardness experimentally obtained are shown in Table 4. To study the influence of finishing force when lubricant is present, tests A.11, A.3, A.6, and A.8 have been done. In order to be easier to compare, in figure 5 are shown the trends of these determinations and the value of the etalon layer, obtained only by turnery.

According to the trends, can be noticed a significant increase of hardness compared with the value of etalon surface. For finishing force and friction coefficient the optimum value is 328,5daN. For 456,2daN the hardness starts to decrease.

Table4. The medium values of Vichers hardness for AlSn10 alloy

| Test code AlSn10 | Finishing Force [daN] | Number of passes | With/without lubrication | Vichers hardness HV10 |
|------------------|-----------------------|------------------|--------------------------|-----------------------|
| A.1. | 248.2 | 1 | no | 44.8 |
| A.2. | 248.2 | 2 | no | 40. |
| A.3. | 248.2 | 1 | yes | 39.1 |
| A.4. | 248.2 | 2 | yes | 38.5 |
| A.5. | 248.2 | 3 | yes | 38 |
| A.6. | 328.5 | 1 | yes | 37.8 |
| A.7. | 328.5 | 1 | no | 37.3 |
| A.8. | 456.2 | 1 | yes | 36.9 |
| A.9. | 143 | 5 | no | 35.4 |
| A.10. | 143 | 5 | yes | 35.6 |
| A.11. | 77.5 | 1 | yes | 35 |
| standard | | | | 31.7 |

To study the effect of number of passes of antifriction layer finished by finplast technology, in fig. 6 are shown together with the values of % of etalon surface, the values of tests A.3, A.4, and A.5., obtained by applying the same force, with lubricant. From the trend is observed that when the number of passes increases, the hardness of antifriction layer decreases, although the differences are not high. In addition, if we compare these values with the similar ones

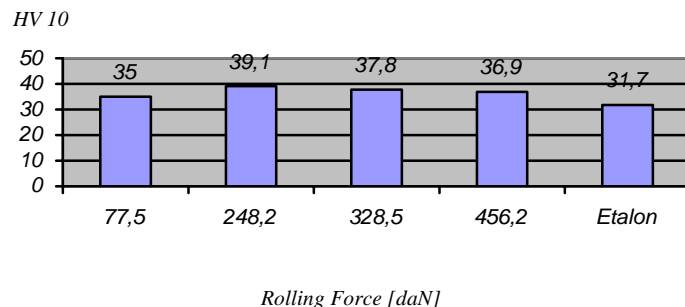


Fig.5. The variation of microhardness HV 10 of AlSn10 alloy depending of the increase of finishing force, with lubricant.

A.1 and A.2 obtained without lubricating oil, we will observe that in both cases the presence of lubricating oil decreases the hardness of antifriction alloy layer. According to Table 4, when finishing force increases, comparing tests A.6 with A7, and A.9 with A.10, the influence of lubricating oil is insignificant.

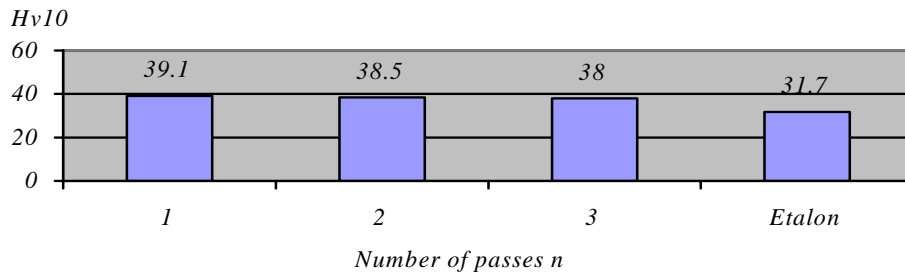


Fig.6. The variation of microhardness HV10 for AlSn10 alloy, depending of increase of number of passes n

3.2. Conclusions:

For AlSn10 alloy, can be observed the following:

- The hardness of antifriction alloy layer shows an optimum value depending of the finishing force between maximum and minimum values used.
- The increase of number of passes n decreases the hardness of antifriction alloy layer
- The presence of lubrication during finishing by finplast technology decreases the hardness of layer.

3.3. The study of the effect of finplast technology on the hardness of antifriction layer for CuPb5 alloy

We will analyze the effect of finishing by finplast technology proposed by the author on the hardness of antifriction layer obtained from the second antifriction alloy CuPb5 (B), obtained using warm sintering.

The experimental values of Brinell hardness (HB/2,5/31,5) are shown in Table 5.

Table5. The medium experimental values of Brinell hardness for CuPb5 alloy

| Test Code CuPb5 | Finishing Force [daN] | Number of passes | With/Without lubrication | Brinell Hardness HB 2.5/31.5 |
|-----------------|-----------------------|------------------|--------------------------|------------------------------|
| B.1 | 77,5 | 1 | No | 49,07 |
| B.2 | 248,2 | 1 | No | 55,42 |
| B.3 | 248,2 | 2 | No | 66,90 |
| B.4 | 248,2 | 3 | No | 67,07 |
| B.5 | 328,5 | 1 | Yes | 63,25 |
| B.6 | 328,5 | 2 | Yes | 71,15 |
| Etalon | | | | 39,5 |

For a better evaluation of the effect of finishing by finplast technology on the hardness of antifriction layer, same as for the first alloy A, in the last row of Table 5 is shown for comparison the value of the hardness of etalon layer, obtained only by turnery. In order to evaluate the influence of increasing of finishing force F, tests B.1, B.2, B.5 have been done. In all these situations only one pass was done (n=1). In Figure 7 is shown the trend of hardness of antifriction layer compared with the value of etalon layer. According to the graph, the hardness increases significantly compared with the etalon one and proportional with the increase of finishing force.

To study the effect of number of passes n, have been shown in fig.8 the values determined for tests B.2; B.3; B.4. and the hardness of etalon test. The tests have been obtained without lubrication, applying the same finishing force. From the trend results that the hardness significantly increases compared with the etalon one and proportional increases with the number of passes.

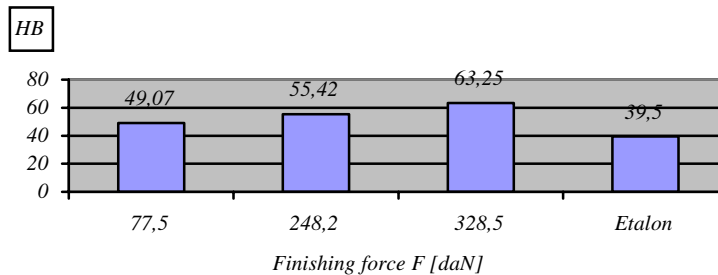


Fig.7. Variation of microhardness HB 2,5/31,5 depending of the increase of force for CuPb5 alloy.

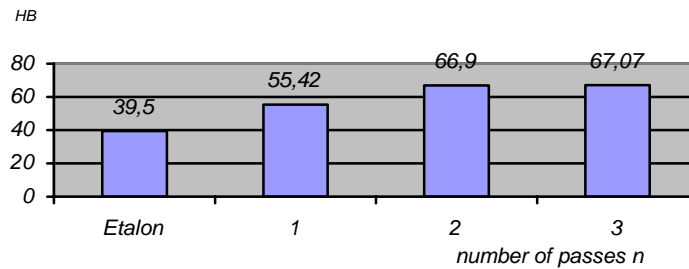


Fig. 8 The variation of microhardness HBS 2.5/31.5, with the increase of number of passes n, without lubricant, F=248,2 daN.

The maximum value of the hardness obtained shows a significant increase of over 50%. Over, for test B.6., for 2 passes obtained with an applied force of 328.5daN, with lubricant, the increase is over 70%. This result is more than good, due to the fact that from tribological point of view, a higher hardness allows a reduction of bearings size and a superior reliability.

3.4. Final conclusions

For CuPb5 alloy subjected to finishing by finplast technology, we can conclude the following:

- Regardless the values of the finishing parameters, the hardness of antifriction layer increases. From the value point of view, the increases can exceed over 50% of the values of the hardness of etalon surface.
- Along with the increase of value of finishing force, the hardness shows a continuous increase;
- By increasing the number of passes, can be noticed significant increases of the hardness of the antifriction layer.

4. FINAL CONCLUSIONS

In virtue of the experimental results and also of the analyses shown so far, we can conclude the following general conclusions:

- The both two materials are acting quite different after finishing by finplast technology.
- For the A alloy, finishing by cold plastic deformation reduces the friction coefficient;
- For the B alloy, the friction coefficient rises, which is a negative effect;
- For the A alloy, the increase of number of passes is not advantageous neither for friction coefficient nor for the hardness of superficial layer;
- For the B alloy, the increase of number of passes results in insignificant effects on the friction coefficient, but produces significant high increases of the hardness of antifriction layer.;
- The presence of the lubricant during finishing of surfaces by finplast technology has a positive effect on the friction coefficient, reducing it's value, but also decreases the hardness of obtained layer;
- For B alloy, the presence of lubricant doesn't have significant effects either on the friction coefficient or on the hardness of antifriction layer.
- For each particular case of bearing is necessary a full investigation starting from the maximum values of stresses of the designed bearing.
- The possibility to use a new concept for designing the bearings, developed by the author under the name of structural pre-configuration.

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APPLICATION OF AN APPROXIMATE ANALYTICAL METHOD FOR NONLINEAR POISSON-BOLTZMANN EQUATION

Dumitru DELEANU¹

¹ Assoc. Prof., Department of Mathematical Sciences, Constantza Maritime University

Abstract: Variational iteration method for calculating the approximate solutions of Poisson-Boltzmann equation with appropriate boundary and initial conditions are presented. A particular form of this equation describes the electrostatic field near a wall region for rectangular geometry. The hyperbolic sine function involved is replaced with a cubic polynomial so that initial equation is approximated with a Lienard equation. The results obtained by means of variational iteration method are compared with those obtained from homotopy perturbation method and those obtained by direct numerical integration. An error analysis is conducted to evaluate the performance of proposed solution technique. The results have shown that variational iteration method is a powerful solution technique in the analysis of some kinds of problems.

Keywords: electrostatic field description, Poisson- Boltzmann equation

1. Introduction

In this work, we consider the nonlinear Poisson-Boltzmann equation

$$\frac{d^2 u}{dx^2} = \lambda^2 \sinh u \quad (1)$$

which describe the electrostatic field near a wall region for rectangular geometry. In (1), u is the dimensionless electrical potential and λ the dimensionless inverse Debye length [1]. The nonlinear term in the right-hand side of (1) is related to the free charge density.

The main focus in the literature was concentrated on how to approximate the hyperbolic function on the right-hand of eq. (1), in order to obtain an effective analytical solution [1-3]. The simplest model of the free charge density is the Debye-Huckel approximation

$$\sinh u \approx u \quad (2)$$

As a result, the nonlinear Poisson-Boltzmann equation reduces to the linear equation $u'' = \lambda^2 u$.

However, this simplification limits the prediction of the applied electrostatic potential to values smaller than 25 mV, which is equivalent to the range $u \in [-1,1]$ (Maslyiah). Another model that extends the range of valid solutions to $-\infty \leq u \leq \infty$ proposes splitting electrical potential values in three regions as a way of simplifying the hyperbolic sine function (Philips and Wooding)

$$\sinh u \approx \begin{cases} -\frac{1}{2} \exp(u), & u < -1 \\ u, & -1 \leq u \leq 1 \\ \frac{1}{2} \exp(u), & u > 1 \end{cases} \quad (3)$$

Although this later proposal is more accurate, the drawback is that a considerable number of equations are required and this is not efficient from a computational

viewpoint. The best approximation for $\sinh u$ is obtained with the use of polynomial functions. This new solution strategy for the differential equations of the electrostatic potential was proposed by Oyanader and Arce [3]. The expression that would be the foundation of this work has a polynomial form given by

$$\sinh u \approx au + bu^3 + cu^5 \quad (4)$$

where $a = 1, b = 0.147, c = 0.01367$. This expression can be adjusted if the number of term involved increases to obtain an even better fit or curve representation.

Figure 1 presents the plot of different approximation expression for $\sinh u$, in the range $u \in [0, 2]$. We can observe that the best fit for hyperbolic function is obtained with the use of polynomial functions.

From (1) and (4) we find the next nonlinear second order differential equation (a particular Lienard equation)

$$u'' + Au + Bu^3 + Cu^5 = 0 \quad (5)$$

Where

$$A = -\lambda^2 a, B = -\lambda^2 b, C = -\lambda^2 c.$$

2. Variational Iteration Method. Basic idea.

In recent years a solution technique called Variational Iteration Method (VIM) has been given great importance for solving nonlinear differential equations. VIM is a kind of variational-based analytical technique and has been shown to solve effectively, easily and accurately, a large class of nonlinear problems with approximations which converge quickly to accurate solutions. It was successfully applied to autonomous ordinary differential equations, to nonlinear partial differential equations with variable coefficients, to Schrodinger – KDV, generalized KDV and shallow water equations, to Burgers' and coupled Burgers' equations, to the linear Helmholtz partial differential equation, and other fields .

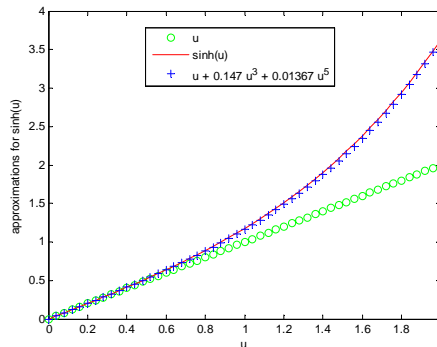


Figure 1: Plot of different approximation expression for $\sinh (u)$

The VIM is proposed by the Chinese mathematician Ji-Huan He as a modification of a general Lagrange multiplier method. To illustrate the basic concepts of the VIM, we consider the following nonlinear differential equation

$$L u + N u = g(t) \tag{6}$$

where L is a linear operator, N a nonlinear operator and g a inhomogeneous term. According to VIM we utilize the correction functional

$$u_{(n+1)}(\bullet, t) = u_{(n)}(\bullet, t) + \int_0^t \lambda(\xi) \left(L u_{(n)}(\bullet, \xi) + N \bar{u}_{(n)}(\bullet, \xi) - g(\xi) \right) d\xi \tag{7}$$

where λ is a Lagrangian multiplier. The superscript (n) indicates the n th approximation and $\bar{u}_{(n)}$ is considered as a restricted variation (i.e. $\delta \bar{u}_{(n)} = 0$). We first determine the Lagrange multiplier λ via integration by parts and then the successive approximations $u_{(n+1)}(\bullet, t)$ of the solution $u(\bullet, t)$ will be obtained using λ and any initial approximation $u_{(0)}$. Consequently, the solution is found from

$$u(\bullet, t) = \lim_{n \rightarrow \infty} u_{(n)}(\bullet, t) \tag{8}$$

3. VIM for Nonlinear Poisson-Boltzmann equation

Determination of Lagrange multiplier

If the above VIM formulation is applied to (5), following iteration formula can be obtained accordingly

$$u_{(n+1)}(x) = u_{(n)}(x) + \int_0^x \lambda(\xi) \left(u_{(n)}''(\xi) + A u_{(n)}(\xi) + B \bar{u}_{(n)}^3(\xi) + C \bar{u}_{(n)}^5(\xi) \right) d\xi \tag{9}$$

where $\delta \bar{u}_{(n)} = 0$. To find optimal value of $\lambda(\xi)$, we have

$$\begin{aligned} \delta u_{(n+1)}(x) &= \delta u_{(n)}(x) + \delta \int_0^x \lambda(\xi) \left[u_{(n)}''(\xi) + A u_{(n)}(\xi) + B \bar{u}_{(n)}^3(\xi) + C \bar{u}_{(n)}^5(\xi) \right] d\xi = \\ &= \delta u_{(n)}(x) + \delta \int_0^x \lambda(\xi) \left(u_{(n)}''(\xi) + A u_{(n)}(\xi) \right) d\xi = 0 \end{aligned}$$

By integration by parts we obtain

$$\begin{aligned} \delta u_{(n+1)}(x) &= \delta u_{(n)}(x) + \delta \lambda(\xi) u_{(n)}'(\xi) \Big|_{\xi=x} - \delta \lambda'(\xi) u_{(n)}(\xi) \Big|_{\xi=x} + \\ &+ \int_0^x [\lambda''(\xi) + A \lambda(\xi)] u_{(n)}(\xi) d\xi = 0 \end{aligned}$$

The stationary conditions are obtained in the following form

$$1 - \lambda'(\xi) \Big|_{\xi=x} = 0, \quad \lambda(\xi) \Big|_{\xi=x} = 0, \quad \lambda''(\xi) + A \lambda(\xi) \Big|_{\xi=x} = 0 \tag{10}$$

In conclusion

$$\lambda(\xi) = \xi - x \quad \text{or} \quad \lambda(\xi) = \sin(\xi - x) \quad \text{or} \quad \lambda(\xi) = \frac{1}{\sqrt{-A}} \sinh \sqrt{-A}(\xi - x) \tag{11}$$

The difference between these formulas is in their convergence speed.

Implementation of the method

Using each of above Lagrange multipliers and iteration formula (9), we can obtain a sequence which tends to the exact solution of equation (5). For simplicity, we consider $\lambda(\xi) = \xi - x$. For initial approximation we choose

$$u_{(0)}(x) = u(0) + x u'(0) \tag{12}$$

As an illustrative example, we consider the following boundary conditions

$$u(-1) = u(1) = \beta, \quad u'(0) = 0 \tag{13}$$

For these boundary conditions, Zhang and He [6] are obtained, using homotopy perturbation method, the next second-order approximate solution for equation (1)

$$u(x) = \beta \frac{\cosh \omega x}{\cosh \omega} + \frac{\beta^3}{192 \omega^2 \cosh^3 \omega} \left(\cosh 3 \omega x - \frac{\cosh 3 \omega}{\cosh \omega} \cosh \omega x \right) \tag{14}$$

where

$$\omega^2 = \lambda^2 + \frac{\beta^2}{8 \cosh^2 \omega} \tag{15}$$

If we start with initial approximation

$$u_{(0)}(x) = u(0) = \alpha \tag{16}$$

and using the iteration formula (9), we can obtain

$$\begin{aligned} u_{(1)}(x) &= u_{(0)}(x) + \int_0^x (\xi - x) \left(u_{(0)}''(\xi) + Au_{(0)}(\xi) + Bu_{(0)}^3(\xi) + Cu_{(0)}^5(\xi) \right) d\xi = \\ &= \alpha - \Lambda \frac{x^2}{2}, \quad \Lambda = A\alpha + B\alpha^3 + C\alpha^5 \end{aligned} \tag{17}$$

$$\begin{aligned} u_{(2)}(x) &= u_{(1)}(x) + \int_0^x (\xi - x) \left(u_{(1)}''(\xi) + Au_{(1)}(\xi) + Bu_{(1)}^3(\xi) + Cu_{(1)}^5(\xi) \right) d\xi = \\ &= \alpha - \frac{\Lambda}{2}x^2 + \frac{\Lambda}{24} \left(A + \frac{3B\alpha^2}{2} + 5C\alpha^4 \right) x^4 - \frac{\Lambda^2}{60} \left(\frac{3B\alpha}{8} + 5C\alpha^3 \right) x^6 + \\ &\quad + \frac{\Lambda^3}{224} \left(\frac{B}{2} + 5C\alpha^2 \right) x^8 - \frac{C\alpha\Lambda^5}{288} x^{10} + \frac{C\Lambda^5}{4224} x^{12} \end{aligned}$$

and so on. The next iterations are difficult to handle so we consider

$$u(x) \approx u_2(x) \tag{18}$$

Because $u(1) = \beta$, we have the next polynomial

$$f(\alpha) = a_1\alpha^4 + a_2\alpha^3 + a_3\alpha^2 + a_4\alpha + a_5 = 0 \tag{19}$$

where

$$\begin{aligned} a_1 &= \frac{5C\Lambda}{24}, \quad a_2 = -\frac{C\Lambda^2}{12}, \quad a_3 = \frac{B\Lambda}{16} + \frac{5C\Lambda^3}{224}, \quad a_4 = 1 - \frac{B\Lambda^2}{160} - \frac{C\Lambda^5}{288}, \\ a_5 &= -\frac{\Lambda}{2} + \frac{A\Lambda}{24} + \frac{B\Lambda^3}{448} + \frac{C\Lambda^5}{4224} - \beta \end{aligned} \tag{20}$$

for determine the unknown α .

4. Numerical results

To verify if the proposed technique yields accurate values for the electrostatic potential variation we chosed $\beta = 1$ and $\lambda = 0.24$. The solution of (19) was obtained graphically (see figure 2). It was $\alpha = 0.96773$.

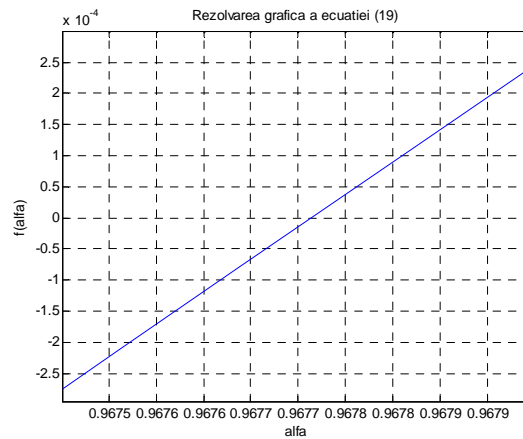


Figure 2: Plot for the equation (19)

Figure 3 shows the plot of electrostatic potential versus the transversal coordinate x , predicted by the numerical integration of the Poisson-Boltzmann equation (1) with Runge-Kutta method, Debye-Huckel approximation and by second-order approximate solution $u_2(x)$. This figure demonstrates that the use of variational iteration method considerably improves the prediction of the electrostatic potential, yielding values nearly identical with the numerical solution.

5. Conclusions

In this study we used a simple procedure to obtain an explicit and purely analytic solution for the prediction of the electrostatic potential. The numerical results show that the method is a powerful and efficient tool for solving such a problem. It is worth pointing out that the VIM presents a rapid convergence to the exact solution, only two iterations being enough for a reasonable accuracy. The calculations in the VIM are simple and straightforward. The approximate solutions are compared with the numerical solutions and the conclusion is that the two sets of results are in excellent agreement.

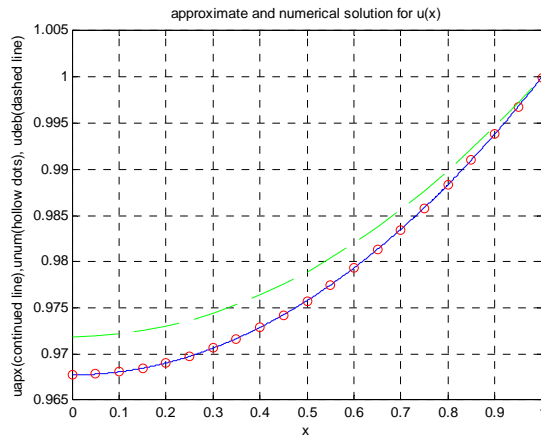


Figure 3: Comparison between VIM solution, Debye-Huckel approximation and numerical solution (Runge-Kutta method)

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ELECTROMAGNETIC COUPLE CONTROL OF AN ASYNCHRONOUS MACHINE

Florențiu DELIU¹
 Silviu GHEORGHIU²

¹ Naval Academy „Mircea cel Bătrân” Constanța, România

² Naval Academy „Mircea cel Bătrân” Constanța, România

Abstract: Operation at variable frequency of asynchronous machine is considering only the statoric flux, or the rotoric flux or the useful constant flux to avoid magnetic saturation and the occurrence of problems of heating, harmonics or couples parasite. In this study we decided to maintain the stator current around the nominal value.

Keywords: voltage, frequency, maximization of the electromagnetic torque.

1. Introduction

To adjust asynchronous machine operation involves the voltage and frequency to vary.

Operation asynchronous machine (MA), both like engine to act with variable speed or as well as generator in various wind and hydraulic systems where speed is the same variable, can be reached where the magnetic flux excess of the nominal magnetic core becomes saturated.

Magnetic saturation generates a series of problems and disadvantages: -currents become unsinusoidal with harmonics given by the ranks 3.5, 7.11

- additional heating due to high frequencies (150.250, [Hz], etc.).

-asynchronous important parasite couples.

Avoiding magnetic saturation can be made only through control of the flows: stator, rotors or useful.

The following develops the method of analysis to control stator flux, the method applied (with minor changes to the other two streams: rotors and useful). Required for voltage and frequency to maintain the stator flux to nominal value or closer to this.

Another condition is used and is often related to stator current limit value, all within the meaning of the above (to avoid overheating).

There are a number of Electrical equipments requiring a mechanical angular acceleration maximum possible for this it is necessary to achieve maximum value for the electromagnetic torque. To maximize the torque function is limited by the restrictions: -Flux and Statoric current.

Asynchronous motor acceleration is also imposed by the maximum value of the statoric current and flux values obtained by maximizing electromagnetic torque method of Lagrange multipliers.

The asynchronous machine adjustment will be made considering the orthogonal model.

Model equations orthogonal on Asynchronous machine, in the transitional regime are:

$$\begin{aligned}
 U_d &= R_1 I_d + L_1 \frac{dI_d}{dt} - \omega_1 (L_1 I_q + M I_{qr}) + M \frac{dI_{dr}}{dt} \\
 U_q &= R_1 I_q + L_1 \frac{dI_q}{dt} + \omega_1 (L_1 I_d + M I_{dr}) + M \frac{dI_{qr}}{dt} \\
 0 &= R_2 I_{dr} + L_2 \frac{dI_{dr}}{dt} - (\omega_1 - \omega) (L_2 I_{qr} + M I_q) + M \frac{dI_d}{dt} \\
 0 &= R_2 I_{qr} + L_2 \frac{dI_{qr}}{dt} + (\omega_1 - \omega) (L_2 I_{dr} + M I_d) + M \frac{dI_q}{dt} \\
 J \frac{d\omega}{dt} &= p_1 M [I_q I_{dr} - I_d I_{qr}] - M_{rez}
 \end{aligned}$$

where :

ω_1 - pulse stator

ω - Angular speed rotors.

Orthogonal model equations in stationary regime are obtained by canceling derivatives, resulting in:

$$\begin{aligned}
 U_d &= R_1 I_d - \omega_1 (L_1 I_q + M I_{qr}) \\
 U_q &= R_1 I_q + \omega_1 (L_1 I_d + M I_{dr}) \\
 0 &= R_2 I_{dr} - (\omega_1 - \omega) (L_2 I_{qr} + M I_q) \\
 0 &= R_2 I_{qr} + (\omega_1 - \omega) (L_2 I_{dr} + M I_d) \\
 M_{rez} &= p_1 M [I_q I_{dr} - I_d I_{qr}]
 \end{aligned}$$

2. Mathematical model

Modeling is done on an engine $P_N = 4$ KW/3000 [rpm], with:

$R_1 = 3$ [Ω] stator involution resistance

$R_2 = 2$ [Ω] rotors involution resistance

$L_1 = 0.3$ [H] own inductance of stator involution

$L_2 = 0.2$ [H] own inductance of rotors involution

$M = 0.21$ [H] mutual inductance between statoric involution and rotoric involution

$J = 0.2$ [kg/m²] moment of inertia

p_1 = number of pole pairs

Adjustment algorithm is considering the electromagnetic torque of the form:

$$M_{elmg} = p_1 M(I_{dr} I_q - I_d I_{qr})$$

Maximum of the function:

$$M_{elmg}(I_d, I_{dr}, I_q, I_{qr}) = 0,21(I_{dr} I_q - I_{qr} I_d)$$

is determined by considering the method of Lagrange multipliers.

It is necessary for the stator current to have maximum value (nominal value in the area), for example:

$$I_{max} = 8[A]$$

or

$$I_d^2 + I_q^2 = 64$$

The statoric flux Ψ_s needs a value close to the magnetic saturation area, for example:

$$\Psi_{s_{max}} = \sqrt{1,5}[Wb]$$

$$\Psi_s = (L_1 I_d + M I_{dr})^2 + (L_1 I_q + M I_{qr})^2$$

or:

$$1,5 = (0,3 I_d + 0,21 I_{dr})^2 + (0,3 I_q + 0,21 I_{qr})^2$$

These two conditions: Ψ_{max} and I_{max} , are the "links" between variables I_d, I_{dr}, I_q, I_{qr} . By limiting the flow to avoid operation in the saturated zone and also by limiting the stator current.

In the last two equations of the model orthogonal:

$$\begin{cases} U_d = R_1 I_d - \omega_1 (L_1 I_q + M I_{qr}) \\ U_q = R_1 I_q + \omega_1 (L_1 I_d + M I_{dr}) \\ 0 = R_2 I_{dr} - (\omega_1 - \omega) (L_2 I_{qr} + M I_q) \\ 0 = R_2 I_{qr} + (\omega_1 - \omega) (L_2 I_{dr} + M I_d) \end{cases}$$

Produces the following relationship between currents:

$$-\frac{I_{dr}}{I_{qr}} = \frac{L_2 I_{qr} + M I_q}{L_2 I_{dr} + M I_d}$$

or

$$L(I_{dr}^2 + I_{qr}^2) + M(I_q I_{qr} + I_d I_{dr}) = 0$$

or

$$0,2(I_{dr}^2 + I_{qr}^2) + 0,21(I_q I_{qr} + I_d I_{dr}) = 0$$

Finally Lagrange function $L(I_d, I_{qr}, I_q, I_{dr}, \lambda_1, \lambda_2, \lambda_3)$ is:

$$\begin{aligned} L(I_d, I_{qr}, I_q, I_{dr}, \lambda_1, \lambda_2, \lambda_3) = & 0,21(I_q I_{qr} - I_d I_{dr}) + \\ & + \lambda_1 (I_d^2 + I_q^2 - 64) + \lambda_2 ((0,3 I_d + 0,21 I_{dr})^2 + \\ & (0,3 I_q + 0,21 I_{qr})^2 - 1,5) + \lambda_3 (0,2(I_{dr}^2 + I_{qr}^2) + 0,21(I_q I_{qr} + I_d I_{dr})) \end{aligned}$$

The extreme points from our system:

$$\begin{cases} \frac{\partial L}{\partial I_d} = -0,21 I_{qr} + 2\lambda_1 I_d + 2\lambda_2 (0,3 I_d + 0,21 I_{dr}) 0,3 + 0,21 \lambda_3 I_{dr} = 0 \\ \frac{\partial L}{\partial I_{dr}} = 0,21 I_q + 2\lambda_2 (0,3 I_d + 0,21 I_{dr}) 0,21 + 0,4 \lambda_3 I_{dr} + 0,21 \lambda_3 I_d = 0 \\ \frac{\partial L}{\partial I_q} = 0,21 I_{dr} + 2\lambda_1 I_q + 2\lambda_2 (0,3 I_q + 0,21 I_{qr}) 0,3 + 0,21 \lambda_3 I_{qr} = 0 \\ 64 = I_d^2 + I_q^2 \text{ (current)} \\ 1,5 = (0,3 I_d + 0,21 I_{dr})^2 + (0,3 I_q + 0,21 I_{qr})^2 \text{ (flux)} \\ 0 = 0,2(I_{dr}^2 + I_{qr}^2) + 0,21(I_q I_{qr} + I_d I_{dr}) \end{cases}$$

Variables in the system are:

$I_d = X$ - the statoric current of axis d;
 $I_q = Y$ - the statoric current of axis q;
 $I_{dr} = Z$ - the rotoric current of axis d;
 $I_{qr} = W$ - the rotoric current of axis q;

Noted:

$I_d = X$
 $I_q = Y$
 $I_{dr} = Z$
 $I_{qr} = W$
 $M_{elmg} = M$

we obtain:

$$\begin{aligned}
 -0,21W + 2X\lambda_1 + 0,6\lambda_2(0,3X + 0,21Z) + 0,21\lambda_3Z &= 0 \\
 0,21Y + 0,42\lambda_2(0,3X + 0,21Z) + \lambda_3(0,4Z + 0,21X) &= 0 \\
 0,21Z + 2Y\lambda_1 + 0,6\lambda_2(0,3Y + 0,21W) + 0,21\lambda_3W &= 0 \\
 -0,21X + 0,42\lambda_2(0,3Y + 0,21W) + \lambda_3(0,4W + 0,21Y) &= 0 \\
 64 &= X^2 + Y^2 \\
 1,5 &= (0,3X + 0,21Z)^2 + (0,3Y + 0,21W)^2 \\
 0 &= 0,2(Z^2 + W^2) + 0,21(YW + XZ) \\
 0,21(YZ - XW) &= M
 \end{aligned}$$

$$\left. \begin{aligned}
 \{ Z = 0; Y = -6,9214; W = 8,8063; \lambda_3 = -0,50123; \\
 M = 7,4189; \lambda_1 = -4,6878 \times 10^{-2}; \lambda_2 = -2,0402; X = -4,0117 \} \\
 \{ Z = 0; \lambda_3 = -0,50123; M = 7,4189; \lambda_1 = -4,6878 \times 10^{-2}; \\
 \lambda_2 = -2,0402; Y = -6,9214; W = -8,8063; X = -4,0117 \} \\
 \{ X = 0; Z = -4,416; W = 7,619; Y = -8,0; \lambda_3 = -0,50123; \\
 M = 7,4189; \lambda_1 = -4,6878 \times 10^{-2}; \lambda_2 = -2,0402 \} \\
 \{ X = 0; Z = 4,416; \lambda_3 = -0,50123; M = 7,4189; \\
 \lambda_1 = -4,6878 \times 10^{-2}; \lambda_2 = -2,0402; Y = -8,0; W = -7,619 \}
 \end{aligned} \right\}'''$$

We obtain 4 sets of solutions, for the same electromagnetic torque and equal to the maximum:
 $M_{max} = 7.4189$ [Nm].

Solutions differ from each other by sign of the voltage U :

$$U^2 = U_d^2 + U_q^2$$

is the same regardless of the option chosen.

With $I_d = X = 0$; $I_q = Z = 8$; $I_{dr} = Z = 4.416$ [A]; $I_{qr} = W = -7.619$ [A] tensions U_d and U_q are written as :

$$U_d = -\omega_1(0,3 \cdot 8 + 0,21 \cdot (-7,619)) = -\omega_1 0,8$$

$$U_q = 24 + \omega_1(0,3 \cdot 0 + 0,21 \cdot 4,416) = 24 + \omega_1 0,927$$

Solutions are obtained:

| | | | | | |
|------------|-----|---|-----|-----|-----|
| $I_d=X$ | 4 | - | 4 | 0 | 0 |
| $I_q=Y$ | 6,9 | - | 6,9 | -8 | 8 |
| $I_{dr}=Z$ | | 0 | 0 | 4,4 | 4,4 |
| $I_{qr}=W$ | | 8 | -8 | 7,6 | - |
| | | | | 7,6 | |

at maximum torque:

$$M_{elmq \max} = 7,4 \text{ [N.m]}$$

Maximize the torque does not depend on speed, as could be seen from the above. Speed acts on the voltage and stator frequency. At any value of the speed, the maximum torque is obtained in circumstances where not exceed the limit values for flux and stator current. MA is used at full capacity. Finally the maximum torque is achieved by imposing voltage and frequency values calculated from algebraic system generated by Lagrange function.

The method is based on the equations of stationary, (algebraic equations) orthogonal model of MA (without derivatives) and for this reason is shown in applications with high moments of inertia (J), where electromagnetic processes can be considered as stationary.

3. Starting at maximum torque

Moment of inertia is known and from the equation of motion can be deduced: statoric voltage and frequency.

Substituting the solutions:

$$I_d = X = 0$$

$$I_q = Y = 8$$

$$I_{dr} = Z = 4.4$$

$$I_{qr} = W = -7,6$$

equations of stator in orthogonal model is obtained:

$$\left\{ \begin{aligned}
 U_d &= 3 \cdot 0 - \omega_1(0,3 \cdot 8 + 0,21(-7,6)) \\
 U_q &= 3 \cdot 8 + \omega_1(0,3 \cdot 0 + 0,21 \cdot 4,4)
 \end{aligned} \right\}$$

Rotors of the equation d axis (or q) leads to the relationship:

$$R_2 I_{dr} = (\omega_1 - \omega)(L_2 I_{qr} + M I_q)$$

or

$$2 \cdot 4,416 = 8,832 = (\omega_1 - \omega)(0,2(-7,619) + 0,21 \cdot 8) = (\omega_1 - \omega)0,1562$$

or

$$\omega_1 = \omega + \frac{8,832}{0,1562} = \omega + 56,543$$

Angular velocity ω of rotor is calculated from the equation of motion:

$$J \frac{d\omega}{dt} = M_{elm} - M_{rez}$$

for which a couple becomes resistant nul

$$0,2 \frac{d\omega}{dt} = 7,4$$

or

$$\omega = 37t$$

Replacing the stator equations U_d and U_q on ω_1 with:

$$\omega_1 = 56.543 + 37t$$

we will obtain:

$$U_d = \omega_1 0.8 = -(56.543 + 37t)0.8$$

$$U_q = 24 + \omega_1 0.927 = 24 + (56.543 + 37t)0.927$$

and by lifting the square, results:

$$U^2 = U_d^2 + U_q^2 = (- (56.543 + 37t)0.8)^2 + (24 + (56.543 + 37t)0.927)^2$$

or

$$U = \sqrt{U_d^2 + U_q^2} = \sqrt{-(56.543 + 37t)0.8)^2 + (24 + (56.543 + 37t)0.927)^2}$$

a. Calculation of frequency and voltage under load at speed of 232,6-263.97 rad / sec.

Variation in time of the actual voltage on a linear variation in frequency over time is almost linear, as can be seen from the figure below.

Considering a moment of inertia J value: $J = 0.2$ [kg · m²] process takes 9 seconds.
 $U(t)$

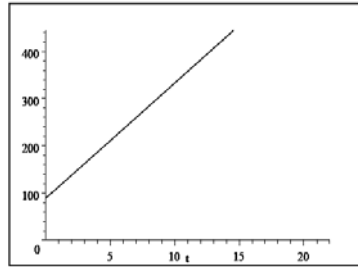


Fig. 2.1 Tension variation over time

Frequency, having regard to the relationship:

$$f_1 = \frac{\omega_1}{2\pi} = \frac{56,543 + 20t}{2\pi}$$

is amended so that while in Figure 2.2.

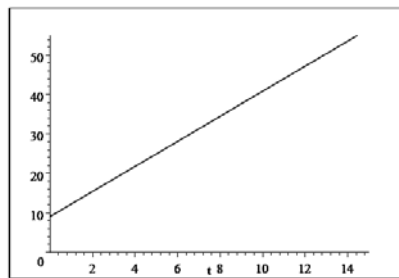


Fig. 2.2 Changes in frequency over time

Viewing the time variation of stator voltage amplitude written in the form:

$$u = U\sqrt{2} \sin \omega_1 t = U\sqrt{2} \sin(56,543 + 37t)t$$

is presented below.

Changes in actual voltage $u(t)$ during the show so that in Figure 2.3:

$$u(t) = U\sqrt{2} \sin \omega_1 t = \sqrt{-(56.543 + 20t)0.8)^2 + (24 + (56.543 + 20t)0.927)^2}$$

$$\sqrt{2} \sin(56,543 + 20t)t$$

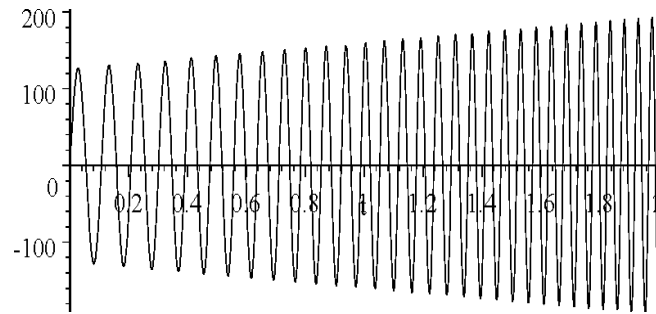


Fig. 2.3 Variation of voltage $u(t)$ during the process

Changes in current $i(t)$ over time shows such as in Figure 2.4:

$$i(t) = I\sqrt{2} \sin \omega t = 8\sqrt{2} \sin(56,543 + 20t)t$$

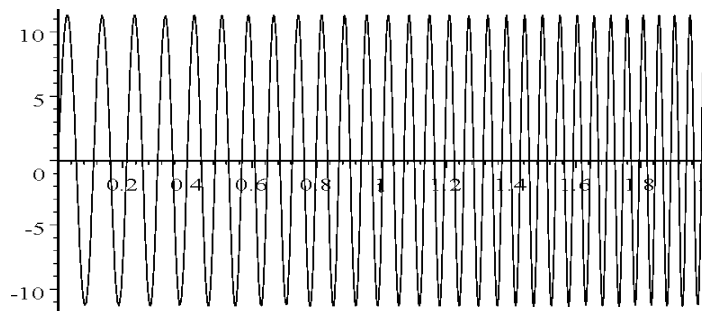


Fig. 2.4 Variation of current $i(t)$ over time

Remarks:

1. at voltage $u(t)$, the amplitude is increasing over time.
2. current $i(t)$ maintains its magnitude at a constant value $8\sqrt{2}$ [A] result of the process of adjusting the stator current to a constant value closer to the nominal value.

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TECHNOLOGIES OF OBTAINING THE MATERIALS USED IN THE PRODUCTION OF BUSHINGS (FRICTION BEARINGS)

Ion DINESCU¹
Gabi BARDOCZ²

¹ Ion Dinescu, Professor Ph.D. Eng., "Henri Coandă" Air Force Academy, Brasov,

² Gabi Bardocz, Ph.D. Eng., "Transilvania" University of Brasov.

Abstract: *The designing of a product always starts from the constructive and functional requirements, which must be fulfilled by the product, thus it is worth to mention the issue of selecting the material out of which that particular product will be made.*

The most important requirements are those concerning the assurance of high mechanical characteristics under special regimes (extreme temperatures, high pressures, corrosive agents, etc.), whereas the weight of the finished product must be minimized by diminishing the density of the materials. Another issue in view is that of material saving, of the wise use of materials by means of rationally conceived projects and scientifically elaborated consumptions. The paper presents a few characteristics of certain alloys necessary in the production of friction bearings used in the military technique.

Key words: *materials, friction bearings, technologies, bimetal.*

1. Introduction

The present development of industry lays emphasis upon the reduction of the raw material usage, the usage of materials in general and steels in particular. The metal usage is maintained at a high level, although the melting loss has been reduced considerably by applying modern processing technologies (plastic deformation instead of splintering, sintering etc.). The dimensions of the parts have been reduced as a consequence of the application of the strength calculation modern methods, the use of substitutes as well as by means of new constructive solutions concerning the weight and the necessary sufficient durability for the specific of that particular plant. In the stage of conceiving a certain product, there is a selection of the materials used, in most cases several materials being chosen.

The rational use of materials in the machine building is determined by the way in which the designers choose different materials according to the charging rate of the piece or construction. An appropriate selection requires a good knowledge of the plant charging rate and of the mechanical behavior of the different material brands.

The materials for the bearings must respond to certain difficult and sometimes contradictory requirements, the high level of the heat density and mechanical stress, specific to the machine building being the first element that has to be taken into consideration.

2. Materials Used in the Production of Friction Bearings

The bearings are subject to fatigue stress, which is a great disadvantage. Besides the size and direction of the load, which stresses the fatigue phenomenon, it is worth to mention that the average value of the specific loads on these bearings can reach 400-800 daN/cm², at important peripheral speeds, direct result of the revolutions of 5000-8000 rev. per min. or even higher, which are frequently used at present. The complexity of the issue concerning the selection of an appropriate material for the bearing is more obvious if we mention the vibrations, the chemical attacks and the influence of the radiations at which the bearings are exposed.

2.1. Metallic Alloys

At present, the main categories of metallic materials used in the production of friction (radial, axial and hydrostatic) are the following ones: [2]

- alloys from the Pb-Sn system;
- cast or sintered Cu-based alloys;
- Al-based alloys;
- other Cd, Zn, Ag-based alloys etc.

The tin based alloys – babbitt – with the following composition 88% Sn, 8% Sb and 4% Cu. This alloy has rapidly become the most frequently used in the production of

bearings all over the world. The white metals presented the attributes of the soft metals, with low melting point, toleration of the untreated cracks, and high capacity of incorporating the foreign particles, which conferred them certain clear advantages in comparison with other anti-friction materials. But the white materials have lost ground in the production of friction bearings all over the world because of the reduced mechanical resistance, especially at high temperatures.

Lead based alloys – Pb based white metals – especially the alloys with As content, are still used both in the United States and Europe because of the advantages offered by the Pb which replaced Sn, the Pb which is not short. The Pb-based alloys contain, in general, Sb, Sn and Cu as alloying elements. Concerning the hardness and resistance, they are similar to the Sn-based alloys, but they are inferior from the point of view of the fatigue strength.

Bronze alloy with Pb, on steel support – is applied by casting or sintering. The Cu-Pb alloys sintered on steel support are more modern than those directly cast on steel strip or support. As related to the lead or tin –based white metals, the copper based alloys have a charging capacity and a strength resistance which are 3-5 bigger, but the high hardness of the copper-based alloys requires a higher pin hardness.

The Al-based alloys – massive bearings have been cast, starting from the idea of obtaining an alloy having a structure similar to that of the babbitt, that is a hard stage alloy in a soft basal mass. It has been proved that such an alloy is more resistant at greater stress than the babbitt or bronze.

An important disadvantage – in extending the Al-Si alloys is the fact that, having constituents with high melting points, they do not present the advantages of those with low hardness, having a more reduced conformability. Recently, in order to replace the lack of conformability, certain companies use the method of working surface galvanic coating of the Al-Si layer or the AlSn6 with an extra Pb-Sn layer thick of about 0,25 mm. This layer achieves a micro-conformability of the bushing working surface during exploitation, thus intertwining the qualities of the Al-Si and AlSn6 alloys (high buoying force lift, chemical stability etc.).

2.2. Materials Under Study – Experimental Research

The materials used in the production of the friction bearings for which there have been used samples and have been carried out studies and experimental research are the following ones: [1, 3]

- base on Al-Sn plated on the steel support;
- based on Cu-Pb sintered powders on steel support.

These samples are presented in Figure 1.

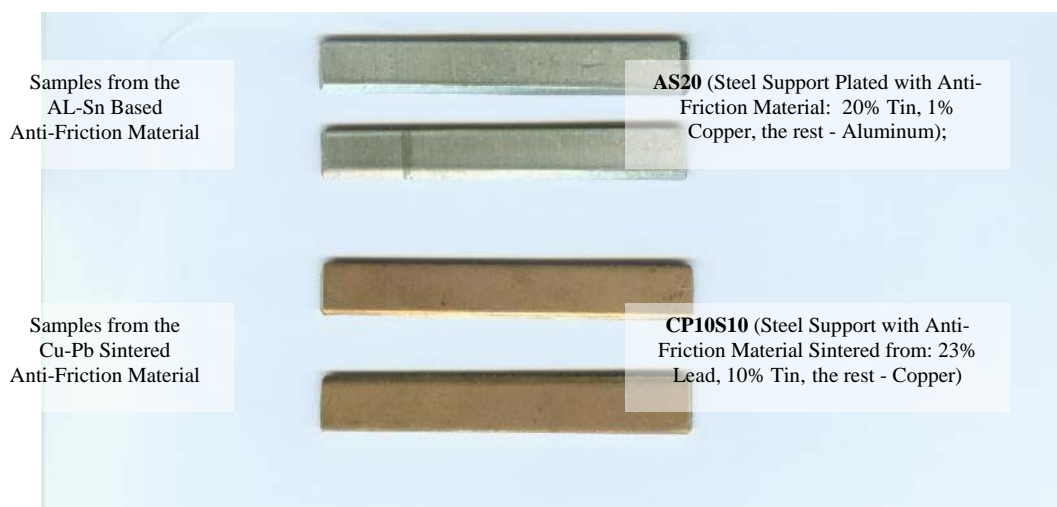


Fig. 1. Samples of Materials Used Within the Framework of the Experimental Research Studies

Concerning these materials, there have been studied the following aspects: chemical composition, micro-structure, certain resistance properties (hardness, stretching resistance, shearing, bending, adherence of the anti-friction layer), values of friction static quotients as well as the technologies of obtaining the anti-friction material and the bearing.

3. Technologies Used in the Production of Friction Bearings

3.1. Production Technology of the AS20 Thin-Walled Bushings

The elaboration and casting of the AS20 alloy (Al – Sn 20%) is made in the following stages:

- the preparation of the charging made of the pre-alloys of Al-Ni, Al-Cu and raw material;
- the melting of the charging;
- the transfer of the alloy, degasification, de-oxidation and maintenance at the casting temperature;
- the casting.

The properties of the anti-friction alloy are greatly determined by its chemical composition. It decides the good behaviour of the ingots at the following lamination operations in which the alloy suffers many structural transformations. Except the basic elements Sn, Cu, Al, Ni, the other two elements Fe and Si are undesired impurities, thus they must be limited at the minimum value. [1]

The alloy temperature must reach 750-760°C. The temperature plays an important role as the alloy must be transferred into the soaking furnace, period of time in which the temperature decreases. This is followed by a heating over the best casting temperature leading to the excessive burning of Sn.

The casting of the anti-friction alloy represents a very important operation which greatly determines the quality of the cast ingots. The appreciation of the quality of the cast ingots is made according to the English standards. There are rejected the ingots presenting gaseous inclusions, faults as “metallic beads”, cold welding or other casting faults. In order to get an ingot with great properties, deprived of casting faults, the ingot butt must be removed, that is the crop end proper.

The elaboration technology of the Al-Sn alloy requires the use of the prealloy made up of Al-Ni and Al-Cu. Because of the huge differences between the melting temperatures of the alloying elements, the nickel and copper will not be introduced directly, but under the form of the pre-alloy Al-Cu and Al-Ni, respectively, which have low melting points. The pre-alloy casting temperature is of 850-860°C.

The main operations for obtaining the double strips of Al-Sn based anti-friction material are the following ones:

- pre-lamination of the AS20 ingots;
- annealing of the pre-laminated ingots;
- plating the alloy ingots with Al foil;
- lamination of the plated ingots;
- plating the steel strips with alloy strip;
- annealing the double strips.

Figure 2 presents the lamination plant of the Al-Sn based anti-friction material on steel support aiming at obtaining the double strip used in the production of friction bearings.



Fig. 2. Lamination Plant of Plated Ingots

The pre-lamination thicknesses of the alloy ingots are chosen according to the final thickness of the alloy from the double strip. The annealing of the pre-laminated ingots is made at the best temperature of 355-360 °C, and the best annealing time duration is of 150 minutes. After plating the alloy ingot with the Al foil and laminating the plated ingots, after a series of secondary operations, the shift is towards plating the steel (support) strips with alloy strips, thus obtaining the double strips.

3.2. The Production Technology of CP10S10 Thin-Walled Bushings

The stages in the production of the thin-walled bushings made of sintered Cu-Pb anti-friction material are the following ones:

- production of alloy powder;
- sintering of the powder on the steel support (obtaining the double strip based on sintered Cu-Pb).

The technological process of obtaining the alloy powder consists of the following operations: the preparation of the cold charging, melting, casting and production of powder. [2]

The melting is made in two gas-furnaces, capable of being swung open, consisting of a swinging melting tank and a collecting crucible. The best melting temperature ranges in between 1200°C and 1280°C. This is maintained during casting in both crucibles. Throughout casting, the mode of action of the atomizers, which will form the powder from the melted alloy is permanently monitored.

In order to obtain the powder, there should be highlighted certain parameters, such as: the pressure of the filtered water, the water softening degree, the regeneration of the de-ionized water, the pressure of the de-ionized water at the atomizers, the moisture of the powder at the entrance of the drier, the temperature at the exit of the drier, neutral air supply in the drier, powder sieving manner, the sieve quality and in the end it can be noticed if the powder corresponds to the requirements. [3]

The technological process of obtaining the double strip based on sintered Cu-Pb consists of the following stages:

- the preparation of the strips (coils) for sintering;
- depositing the powder on the steel strip having in view the sintering;
- the sintering of the powder on the steel strip;
- lamination of the double strip.

The preparation of the steel coils on which the Cu-Pb powder is sintered consists in executing certain operations aiming at assuring a continuous technological process (butt welding of the strips, straightening in order to remove the curvatures and unevenness resulted after welding, washing at the temperature of 77-88°C with water mixed with a degreasing and washing, drying at the temperature of 95°C through infrared rays heating).

The process of depositing the powder for sintering on the steel strip is made by means of a complex plant consisting of: the plant for the strip speed control and adjustment, the depositing plant proper and the suction hood.

The depositing plant proper has a tank dosing the powder quantity according to the calculated alloy thickness and the width of the steel strip.

In order to avoid the oxidation of both the powder and the steel, a neutral atmosphere is needed in the sintering furnace and the sintering speed will be established according to the heating curve of the sintering furnace.

The sintering process on the steel strip ends with the strip cooling. The cooling takes place in a complex and closed plant, the same neutral atmosphere being maintained, just like in the sintering furnace.

The lamination of the sintered strip aims at obtaining the necessary density of the deposited powder.

The Cu-Pb based powder sintering on the steel support is made in the sintering furnace ($T_{\text{sinterizare}}=900-950^{\circ}\text{C}$) presented in Figure 3.



Fig. 3. The Furnace of Cu-Pb based Powder Sintering on Steel Support

According to the hardness of the alloy layer as well as to the tolerance of the double strip thickness, it is recommended to deal with:

- a final sintering and lamination;
- two sinterings and two laminations (a lamination in between the sinterings and a final lamination).

In both cases, the lamination reduction will be made so that not to appear the melting of the lead from the alloy.

4. Conclusions

As the anti-friction material based on Cu-Pb sintered powders has a metallic structure, the relations established during the sintering process between the powder granules can be explained by the inter-atomic forces from the crystalline network of the metals. Theoretically, there is a metallic contact between the powder granules, but practically, this contact is seldom realized due to an oxide coating at the surface of the granules. The concentration of these oxides can be controlled and must not exceed the imposed value of 0.55% in the case of the powder under research, in order to preserve the metallic structure.

Because of the heat from the sintering furnace, the powder deposited on the steel support suffers the phenomenon of surface and volume diffusion (in solid phase). This can be explained by the fact that the atoms situated on the prominences and tips of the powder granules move on the

surface of the granules, concentrating themselves in the surface unevenness. At higher temperatures, the diffusion between the powder granules and those of the steel support takes place.

The factors which influence the Cu-Pb powder sintering on the steel support are: the sintering temperature, the heating speed and the cooling speed, the sintering atmosphere, the size of the powder granules, the powder type, diffusion (at the limit in between the granules, surface limit, volume limit), chemical composition of the powder.

The mixture of alumina and tin oxide is accepted only if the surface occupied by them does not exceed 80% of the interface length.

The structures with sulphide inclusions, with foreign bodies inclusions and small cracks are accepted according to the adherence tests (chiselling, peeling).

The structures with superficial corrosion of tin melt at the alloy surface during annealing and inter-crystalline corrosion are inappropriate.

The super-sintering is not admitted in the structure of the sintered alloy.

The double strips must not present a series of faults, such as: overlaps because of lamination, surface slag imprints, oxide traces after pickling, foreign bodies inclusions, cracks.

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OUTPUT ELECTRIC CURRENT’S MODELING AND SIMULATION OF A FLUX COMPRESSION GENERATOR COIL

Vasile DOBREF¹
Alexandru SOTIR²
Octavian TARABUTA³
Mircea Constantinescu⁴

¹ Ph.D Senior Lecturer Commander Mircea cel Batran” Naval Academy “Ph.D Professor “Mircea cel Batran” Naval Academy

² Ph.D Professor “Mircea cel Batran” Naval Academy

³ Ph.D Instructor Commander “Mircea cel Batran” Naval Academy

⁴ Ph.D Senior lecturer Mircea cel Batran” Naval Academy

Abstract: The present technology used for the generation of an electromagnetic pulse (EMP) in defence applications has been implemented starting with three sorts of generators so far: flux compression generators (FCG), magneto-hydrodynamic (MHD) generators and virtual cathode oscillators (VCO). This paper describes the basic principles of the most common and effective type of generator, the FCG and particular results obtained by a research team of the Romanian naval academy during designing and building an electromagnetic bomb prototype. As the FCG requires a coil, the authors present hereinafter the preliminary calculations of the output current that have been used in the actual design. All the results presented hereby have been demonstrated by the actual prototype developed.

Key words: EMP, electromagnetic, pulse, generator, bomb

1. INTRODUCTION

Following the trail of new applications development regarding the modern warfare information strategy and tactics, the technologies based on the high energy electromagnetic pulse evolved continuously (Abrams, 2003). The newly developed research have been leading to the so called electromagnetic bombs (projectiles), *E-bombs*, capable of taking out enemy’s C4I (command, control, communication, computers & intelligence) equipment and systems with no collateral casualties.

The first damaging effects of the electromagnetic pulse (EMP) have been noticed during the high altitude nuclear weapons tests, when intense, extremely brief EMPs (hundreds of nanoseconds) have been generated and transmitted over some distance according to Maxwell’s equations of the electromagnetic field.

2. MODELING AND SIMULATION OF THE OUTPUT CURRENT DUE TO THE EXPLOSION

Physically, an FCG is built from a copper cylinder (the armature) which holds inside the explosive charge. A copper thick wire helical coil, standing for the stator is placed around with a sufficient air gap needed for the explosive’s expansion during the explosion. The initial current is produced through the discharge of an external capacitor battery.

In order not to prematurely destroy the generator, a thick protective non-magnetic material wrapping (fiber glass or Kevlar) is placed on the coil’s external surface – see Figure 1.

The simulation of the final current in the coil, estimated to be produced by the explosive’s detonation, has been done by the means of a MATLAB program called PSCF-1.

The modeling of the coil current during the shortcircuit took into account a linear evolution of the inductivity and resistance of the RL series circuit, that is they are functions of time as variable (Fowler et al., 1993). The solution of the differential equation depends in this case by the integrals emerging in the computing program.

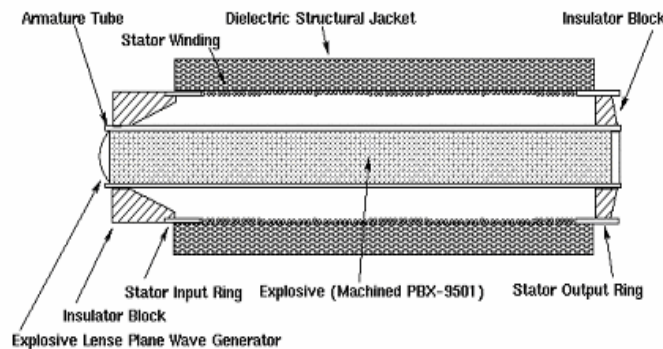


Fig. 1 Flux Compression Generator’s architecture.

Thus, we considered:

$$R(t)=R_0(1-kt), R_0=R \text{ and } R_T(t)=R(t)+R_b \tag{1}$$

where:

$R=0,00155 \Omega$ is the overall resistance of the coil, with the loop and the armature; $R_b=3,6298 \cdot 10^7 \Omega$ is the resistance of the current (load) loop considered to be constant.

$$k = \frac{1}{t_i} = \frac{1}{52,14 \cdot 10^{-6}} = 1,9178 \cdot 10^4 (s^{-1})$$

$$\text{and } t_i = \frac{l}{v_C} = \frac{0,365}{7000} = 52,14 \cdot 10^{-6} (s) = 52,14 (\mu s)$$

is the explosion propagation duration.
 On the other hand,

$$L=L_0(1-kt), L_0=L \text{ and } L_T(t)=L(t)+L_b \quad (2)$$

There have been studied two cases (Dobref et al., 2008):

1^o The real (measured) electrical parameters of the coil and the current loop and the coil has an interior cylinder. In this case, the values are: $L_0=42\mu H, R_0=0,097\Omega, L_b=0,1498\mu H, R_b=0,006466\Omega, L_p=2 nH$.

2^o The real (measured) electrical parameters of the coil and the current loop and the coil doesn't have an interior cylinder. For this case, the values are: $L_0=22\mu H, R_0=0,097\Omega, L_b=0,1498\mu H, R_b=0,006466\Omega, L_p=2 nH$.

Considering that

$$R_C=R+R_b; L_C=L+L_b \quad (3)$$

The equations (1) and (2) become:

$$R_T(t)=R_C-kR(t) \text{ and } L_T(t)=L-kL(t) \quad (4)$$

As we analyze the transitory process starting with the moment of coil's short-circuiting, the differential homogenous equation of the RL series circuit has the well-known form:

$$\frac{d}{dt} L_T(t)i(t) + R_T(t)i(t) = 0 \quad (5)$$

In the same time, we know that:

$$\frac{d}{dt} \{ [L(t) + L_b] \cdot i \} = [L(t) + L_b] \cdot \frac{di}{dt} + i \frac{d}{dt} [L(t) + L_b] \quad (6)$$

and

$$\frac{d}{dt} [L(t) + L_b] = -kL_0 \quad (7)$$

Equation (5), amended by the equations (6) and (7), is now:

$$(L_c - kL_0t) \frac{di}{dt} - kL_0i + (R_c - kRt) \cdot i = 0 \quad (8)$$

or

$$(L_c - kL_0t) \frac{di}{dt} + [(R_c - kL_0) - kRt]i = 0 \quad (9)$$

Equation (9) can be expressed as:

$$\frac{di}{dt} + \frac{(R_c - kL_0) - kRt}{L_c - kL_0t} i = 0 \quad (10)$$

or:

$$\frac{di}{dt} + \left[\frac{R_c - kL_0}{L_c - kL_0t} - \frac{kRt}{L_c - kL_0t} \right] \cdot i = 0 \quad (11)$$

If we equalize the expression in the brackets with P(t), we obtain:

$$P(t) = \frac{R_c - kL_0}{L_c - kL_0t} - \frac{kRt}{L_c - kL_0t} \quad (12)$$

Therefore, equation (11) will be written as:

$$\frac{di}{dt} + P(t) \cdot i = 0 \quad (13)$$

After solving the equation (13), the formula of the transitory current through the coil, during the explosion, has the form:

$$i_l(t) = I_0 \cdot e^{-\int_0^t P(t') dt'} = I_0 \cdot e^{1(t)} \quad (14)$$

The computing program has numerically solved the equations above and has two reverse applications.

a) If we want to find out the initial currents needed to obtain imposed output currents (for example, 15 kA; 10 kA; 5 kA), according to a known elapsed time of the explosion, from equation (14) we will have:

$$I_0 = \frac{i(t_i)}{\exp[eI(t_i)]} \tag{15}$$

Where, again, we chose the values $i(t_i)=15kA; 10kA; 5kA$. Accordingly, we have found the values:

$$I_{01} = \frac{15000}{\exp[eI(t_i)]} = 226,163916(A)$$

$$I_{01} = \frac{10000}{\exp[eI(t_i)]} = 150,77594453(A)$$

$$I_{01} = \frac{5000}{\exp[eI(t_i)]} = 75,387972(A)$$

b) On the basis of equation (14) we can find out the output current through the FCG coil with parametric resistance and inductivity, for the two cases mentioned above: the coil with or without an interior cylinder.

1^o The coil with an interior cylinder.

We adopted in the computations an initial current $I_1 = 551A$. The diagram of the function $i(t)$ for the respective time interval is presented in Figure 2. The computations have resulted into an output current $I_{out} = 128,158.84 A$.

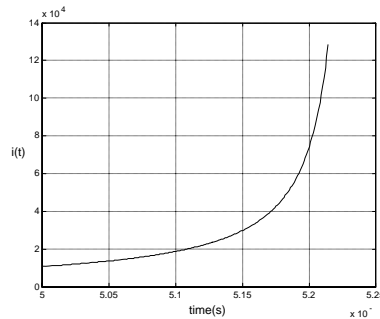


Fig. 2. Output current for the coil with an interior cylinder.

2^o The coil without an interior cylinder.

The starting current was $I_1=571 A$. The evolution of the output current during the explosion is presented in Figure 3. The final value of the current was $I_{out} = 61,385.62 A$.

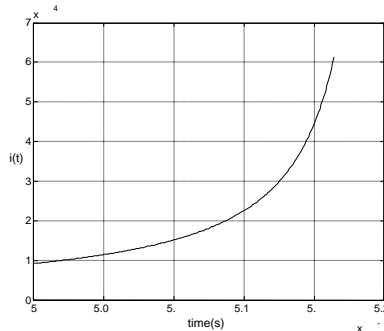


Fig. 3. Output current for the coil without an interior cylinder.

3. CONCLUSION

By comparing the two output currents subsequent to the short-circuiting process, we notice that the presence of an internal metallic cylinder (steel) doubles the size of it.

The results of the modeling and simulation have been used in further experimentation of a real FCG prototype and proved to be very close to the experimental data. On the other hand, the results of the present research could be used reversely, in order to take proper measures of protecting electrical devices from the electromagnetic pulse damaging effects.

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THE HYDROELASTIC DYNAMIC RESPONSE IN IRREGULAR HEAD WAVES, FOR A 6500 TDW CHEMICAL TANKER SHIP

Leonard DOMNISORU¹
Liviu Dan STOICESCU²
Daniela DOMNISORU³

¹ Leonard Domnisoru, prof.univ.dr.ing. University “Dunare de Jos” Galati, Naval Architecture Faculty

² Liviu Dan Stoicescu, prof.univ.dr.ing. University “Dunare de Jos” Galati, Naval Architecture Faculty

³ Daniela Domnisoru, drd.fiz. University “Dunarea de Jos” Galati, Sciences Faculty/ Physics

Abstract: In this paper is presented the study of the steady state and transitory hydroelastic dynamic response of a full scale 6500 tdw chemical tanker ship, induced by irregular head waves, model Longuet-Higgins. There are considered two load cases: full cargo and ballast. The analyses have been carried on with the eigen program DYN. The numerical model includes linear-modal frequency domain procedures and also non-linear time domain implicit integration procedures for the motion equations solution. The numerical results pointed out the occurrence of the slamming phenomenon at both ship extremities, so that in the ship girder are recorded very high whipping transitory vibrations. For the numerical analyses is used the chemical tanker model provided by the ICEPRONAV Galati, in the frame of the CEEX EU-SSS Project. The numerical results pointed out that the non-linear analyses could reveal the extreme wave loads in the ship hull structure.

Keywords: ship dynamic response, slamming, whipping, irregular waves, hydroelasticity theory

1. Introduction

In this study is analysed the irregular head waves induced dynamic response for a 6500 tdw chemical tanker ship (table 1). The aft peak form is designed for azipod propulsion, with extended console zone. The fore peak form starts with a bulbous zone, continued by a flare side shape up to the deck (fig.2).

Based on preliminary linear seakeeping analyses [1],[6], due to the ship extremities form and the sea state intensity, the numerical results for the relative vertical motion ship-wave are pointing out that the bottom and side slamming phenomena can occur with high probability at fore peak and also at aft peak.

In order to obtain the ship hull wave induced dynamic loads and the motion parameters, in this study the numerical analyses are developed based on a non-linear ship hull hydroelasticity theory [3], [4], [7], [9], [11], [13], [14], [16], making possible to include the following dynamic response components: the linear and non-linear oscillations (low frequency response), taking into account the bottom and side slamming phenomena, and the vibrations on the first and higher eigen modes (high frequency response), taking into account the whipping and springing phenomena.

2. Theoretical background

The linear and non-linear hydroelastic theoretical model is based on the following hypotheses:

- the ship hull is modelled with the finite element method (1D-FEM), using elastic beam finite elements, Timoshenko model [6];
- the ship offset lines are modelled with the conformal multi-parametric transformation method [2];
- the hydrodynamic excitation forces are modelled according to the hydroelasticity theory and the strip theory, with non-linear terms and the slamming components, based on the generalization of the Gerritsma & Beukelman model [1],[2],[6];
- the hydrodynamic coefficients, in the non-linear ship motion equations, are calculated for the instantaneous position between ship and wave free surface, based on the Porter & Vugts potential fluid flow method [2]; it is used an interpolation procedure for the current immersion step, based on the hydrodynamic coefficients previous calculated for 20 reference draughts at each transversal section [4];
- the ship dynamic response is decomposed, according to the modal analysis technique, on ship oscillation (low,rigid hull) and vibration (high, dry hull) modes [6];
- the excitation is the external head wave, model Longuet-Higgins, with second order interference components [4],[7],[12],[14],[15].

Based on the theoretical model, in detail presented by Domnisoru [4],[6] the numerical analyses are carried on with eigen program DYN, which includes the linear solver STABY and the non-linear solver TRANZY. The main logical scheme for DYN program package is presented in fig.1. The eigen program DYN has been validated based on the experimental data obtained at the Galati towering tank [4],[5] and also into a common benchmark directed by the Bureau Veritas [8].

The STABY module is developed for the steady state ship dynamic response, including the linear oscillations and springing phenomenon components. There are included the following steps:

- input ship data, eigen modes, first order wave spectra, ITTC type [2],[6];
- the calculation of the Longuet-Higgins (L-H) time domain wave elevation, with random component phases, having

the following condensed equation [4],[15]:

$$\eta_w(x, t) = \sum_{(\omega_e)} \left[\eta_w^c(x, \omega_e) \cos \omega_e t - \eta_w^s(x, \omega_e) \sin \omega_e t \right] \quad (1)$$

where ω_e is the encountering ship-wave equivalent circular frequency of a wave component; $\eta_w^{c,s}(x, \omega_e)$ are the ω_e wave frequency domain components; x is the space coordinate in the ship system; t is the time coordinate;

- the calculation of motion equation system terms: structural, hydrodynamic and wave excitation forces;

The motion equation system at the linear solution, based on the modal analysis technique, has the following expression:

$$\left[\mathbf{a} + \mathbf{A}_h \right] \left\{ \ddot{\mathbf{p}}_{in} \right\} + \left[\mathbf{b} + \mathbf{B}_h \right] \left\{ \dot{\mathbf{p}}_{in} \right\} + \left[\mathbf{c} + \mathbf{C}_h \right] \left\{ \mathbf{p}_{in} \right\} = \left\{ \mathbf{F}_w(t) \right\} \quad (2)$$

$$\left\{ \mathbf{p}_{in}(t) \right\} = \sum_{(\omega_e)} \left[\left\{ \mathbf{p}_{in}^c(\omega_e) \right\} \cos \omega_e t - \left\{ \mathbf{p}_{in}^s(\omega_e) \right\} \sin \omega_e t \right]; \left\{ \mathbf{F}_w(t) \right\} = \sum_{(\omega_e)} \left[\left\{ \mathbf{F}_w^c(\omega_e) \right\} \cos \omega_e t - \left\{ \mathbf{F}_w^s(\omega_e) \right\} \sin \omega_e t \right]$$

where $[\mathbf{a}], [\mathbf{b}], [\mathbf{c}]$ are the modal ship structural matrixes; $[\mathbf{A}_h], [\mathbf{B}_h], [\mathbf{C}_h]$ are the modal hydrodynamic matrixes; $\{\mathbf{p}_{in}(t)\}$ is the linear modal time response; $\{\mathbf{F}_w(t)\}$ is the equivalent modal excitation force vector, induced by the external wave; $\mathbf{p}_{in}^{c,s}(\omega_e)$, $\mathbf{F}_w^{c,s}(\omega_e)$ are the frequency domain components for wave ω_e .

– the solution in frequency domain of the linear ship dynamic response, on each wave component ω_e , using a Gauss type numerical procedure;

$$[D(\omega_e)]\{X(\omega_e)\} = \{F(\omega_e)\}; \{X(\omega_e)\} = \left\{ \{p_{lin}^c(\omega_e)\}, \{p_{lin}^s(\omega_e)\} \right\}^T; \{F(\omega_e)\} = \left\{ \{F_w^c(\omega_e)\}, \{F_w^s(\omega_e)\} \right\}^T \quad (3)$$

$$[D(\omega_e)] = \begin{bmatrix} \delta_1 & -\delta_2 \\ \delta_2 & \delta_1 \end{bmatrix}; \delta_2 = \omega_e [b + B_h(\omega_e)]; \delta_1 = -\omega_e^2 [a + A_h(\omega_e)] + [c + C_h(\omega_e)]$$

– the linear ship dynamic response, based on spectral composition in time domain, $\{p_{lin}(t)\}$, according to equation (2). The TRANZY module is developed for the non-linear and transitory ship dynamic response, including non-linear oscillations and springing, slamming (bottom & side) and whipping components. There are included the following steps:

– input ship data, eigen modes, structural matrixes, time domain wave model Longuet-Higgins, the linear time domain ship dynamic response, equations (1)-(3);

– the calculation of the motion equation terms:

$$[A]\{\ddot{p}_{nl}(t)\} + [B]\{\dot{p}_{nl}(t)\} + [C]\{p_{nl}(t)\} = \{F_{nl}(t)\}; \{F_{nl}(t)\} = \{F_{nl}(t, \{p_{lin}(t) + p_{nl}(t)\})\} \quad (4)$$

$$[A] = [a] + [A_h]_{\omega_2}^{\omega_{osc}}; [B] = [b] + [B_h]_{\omega_2}^{\omega_{osc}}; [C] = [c] + [C_h]_{\omega_2}^{\omega_{osc}}$$

where $[A],[B],[C]$ are the total modal matrixes, considering as significant the response on the oscillation ω_{osc} modes and the first eigen vibration mode ω_2 ; $\{F_{nl}(t)\}$ is the modal excitation force vector of the non-linear modal time response $\{p_{nl}(t)\}$;

– the solution of the differential non-linear equation system (4), using a time domain integration procedure, β -Newmark, at each iteration, with the total simulation time of $T_s=80s$ and the time step $\delta t=0.01s$;

$$\text{step 0: } \{p_{nl}\}^{(0)} = 0 \Rightarrow \{F_{nl}(t)\}^{(1)} = \{F_{nl}(t, \{p_{lin}(t)\})\} \quad (5)$$

step 1: time domain integration with β -Newmark:

$$[A]\{\ddot{p}_{nl}\}^{(1)} + [B]\{\dot{p}_{nl}\}^{(1)} + [C]\{p_{nl}\}^{(1)} = \{F_{nl}(t)\}^{(1)} \Rightarrow \{p_{nl}(t)\}^{(1)}$$

step k: time domain integration with β -Newmark:

$$\{p_{nl}(t)\}^{(k)} \Rightarrow \{F_{nl}(t)\}^{(k+1)} = \{F_{nl}(t, \{p_{lin}(t) + p_{nl}^{(k)}(t)\})\}$$

step k+1: time domain integration with β -Newmark:

$$[A]\{\ddot{p}_{nl}(t)\}^{(k+1)} + [B]\{\dot{p}_{nl}(t)\}^{(k+1)} + [C]\{p_{nl}(t)\}^{(k+1)} = \{F_{nl}(t)\}^{(k+1)}$$

... until the convergence criteria is reached:

$$\max_{r,t} |p_{nlr}^{(k+1)}(t) - p_{nlr}^{(k)}(t)| / \max_{r,t} |p_{nlr}^{(k)}(t)| \leq \varepsilon = 0.001$$

- the time domain non-linear ship dynamic response;
- the total time domain dynamic response has the following expression:

$$p_r(t) = p_{linr}(t) + p_{nlr}(t) \quad w(x,t) = \sum_{r=0}^n w_r(x) p_r(t) \quad r=0, n \quad x \in [0, L] \quad (6)$$

$$M(x,t) = -EI_y(x) \sum_{r=0}^n \theta'_r(x) [p_r(t) + \beta_r(x) \dot{p}_r(t)]$$

$$T(x,t) = GA_{tz}(x) \sum_{r=0}^n \gamma_r(x) [p_r(t) + \alpha_r(x) \dot{p}_r(t)]$$

where: $w(x,t)$ is the vertical displacement plus deformation; $M(x,t)$ is the bending moment; $T(x,t)$ is the shearing force; $n=4$, with $r=0,1$ the heave and pitch oscillation modes, $r=2,3,4$ the eigen ship vibration modes; $w_r(x), \theta_r(x), \gamma_r(x)$ are the modal form functions for the displacement field, based on the 1D-FEM method [6]; $EI_y(x), GA_{tz}(x)$ are the bending and shearing rigidities; $\alpha_r(x), \beta_r(x)$ are the structural damping coefficients; L is the ship length.

- the short-term statistical parameters, the spectral analysis is applied to the total ship dynamic response, based on the FFT Fast Fourier Transformation Method[6].

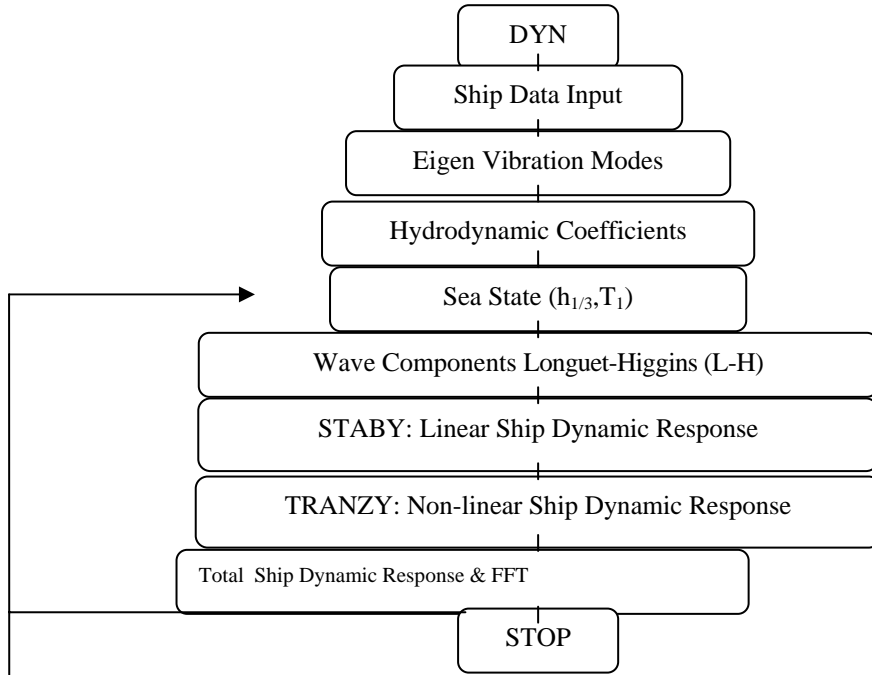


Fig.1: The main logical scheme of eigen DYN program package.

3. The 6500 tdw chemical tanker ship model data for the numerical analysis

In this study is considered a chemical tanker ship TCH 6500 tdw, with the main dimensions from table 1. The statistical maxim wave height h_{maxGL} is according to Germanischer Lloyd's Rules [10]. The ship offset section lines are presented in fig.2.

Table 1: The 6500 tdw chemical tanker ship main dimensions

| | | | | | | | |
|-------|-----------|---|-------|-----------|------------|---|-----|
| – [m] | LOA | – | 107.1 | – [m] | d_{MLD} | – | 6. |
| – [m] | LBP | – | 100.7 | – | C_B | – | 0. |
| – [m] | B_{MLD} | – | 18.2 | – | h_{maxG} | – | 8 |
| – [m] | D_{MLD} | – | 8.7 | – [m] | L | – | 14 |
| – [m] | | – | | – [Knots] | v | – | -15 |

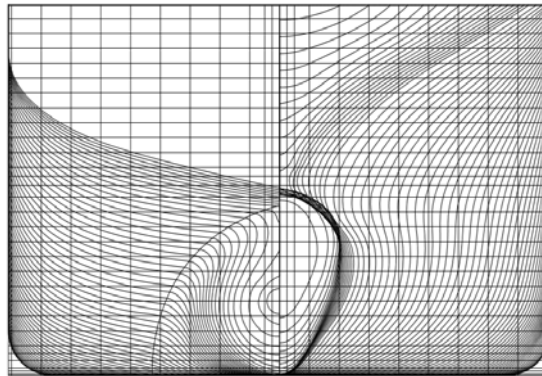


Fig.2: The 6500 tdw chemical tanker offset section lines

The hull structure of the 6500 tdw chemical tanker ship is with scantlings according to the Germanischer Lloyd's Rules[10]. The chemical tanker amidships section and material (steel) characteristics are presented in table 2, as following: the moment of inertia I_y [m^4], the section area A [m^2] and the equivalent shearing area A_{tz} [m^2], the bottom and deck bending modules W_B , W_D [m^3], the coefficient of maxim shearing stress in the neutral axis K_{m-n} [m^{-2}] (7), the Young elasticity module E [N/m^2], the Poisson coefficient ν , the material density ρ_m [t/m^3], the bending β and shearing α structural damping [2]. The structural characteristics are considered with a trapeze distribution over the ship length.

$$K_{t_{n-n}} = \frac{S_{y_{n-n}}}{I_{yy} \cdot 2 \cdot t_{n-n}} ; t_{n-n} = t_s + t_{DS} \quad (7)$$

where: $S_{y_{n-n}}$ is the transversal section static moment at the neutral axis $n-n$; t_s, t_{DS} are the thickness of the side and double side shells (double hull ship structure).

The ship structure material yield stress limit is $R_{eH}=235\text{N/mm}^2$, except the deck panel structure $R_{eH}=315\text{N/mm}^2$, with the admissible normal and tangential stresses, at ship longitudinal strengths, according the Rules of Germanischer Lloyd [10], presented in table 3.

In table 4 are presented the loading cases for the 6500 tdw chemical tanker ship: full cargo and ballast, where Δ is the displacement; x_G is the ship weight centre, d_m, d_{aft}, d_{fore} are the ship draughts: medium, aft peak, fore peak; v is the ship navigation speed. In figs.3.a,b are presented the mass diagrams for the 6500 tdw chemical tanker ship.

Based on the rigidity and inertial characteristics of the 6500 tdw chemical tanker ship, are calculated the eigen oscillation and vibration (dry and wet hull) mode frequencies, from table 5. In this case, the hydrodynamic masses are calculated at the ship still water equilibrium position and are constant in time. In fig.4 there are presented the modal form functions for the full cargo loading case (considering dry hull at vibration modes).

Table 2: The TCH 6500 tdw amidships section and material characteristics

| | | | | | | | |
|---|----------------------------------|---|--------|---|-------------------------------|---|---------------------|
| – | I_y [m ⁴] | – | 15.170 | – | E [N/m ²] | – | $2.1 \cdot 10^{11}$ |
| – | A [m ²] | – | 1.307 | – | v | – | 0.3 |
| – | A_{tz} [m ²] | – | 0.662 | – | ρ_m [t/m ³] | – | 7.7 |
| – | W_B [m ³] | – | 4.019 | – | R_{eH} [N/mm ²] | – | 235 / 315 |
| – | W_D [m ³] | – | 3.080 | – | $\alpha = \beta$ | – | 0.001 |
| – | $K_{t_{n-n}}$ [m ⁻²] | – | 2.305 | – | No EL / DOF | – | 40 / 82 |

Table 3: The material admissible stresses (steel) [10]

| | | | | | |
|---|-------------------------------|---|-------------------------------------|---|-----------------------------------|
| – | Yield stress | – | Normal stress | – | Tangential stress |
| – | R_{eH} [N/mm ²] | – | σ_{adm} [N/mm ²] | – | τ_{adm} [N/mm ²] |
| – | 235 | – | 175 | – | 110 |
| – | 315 | – | 224 | – | 141 |

Table 4: The TCH 6500 tdw chemical tanker ship loading cases

| | | | | | | | | | | | | | | | |
|---|-----|---|-----------|---|--------------|---|-----------|---|-----------|---|---------------|---|----------------|---|-------------|
| – | No. | – | Load case | – | Δ [t] | – | x_G [m] | – | d_m [m] | – | d_{aft} [m] | – | d_{fore} [m] | – | v [Knots] |
| – | 1 | – | Full load | – | 9094 | – | 54.14 | – | 6.40 | – | 6.40 | – | 6.40 | – | 14.8 |
| – | 2 | – | Ballast | – | 6543 | – | 53.69 | – | 4.80 | – | 5.29 | – | 4.29 | – | 14.8 |

Table 5: Eigen ship modes frequencies f[Hz]

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--|--|--|----------------------|--|---|--|--------------|--|---|--|----------|--|------------|--|----------|--|---|--|----------|--|---|--|----------|--|---|--|-------|--|---|--|-------|--|
| – | | | | TCH 6500tdw f [Hz] | | – | | Oscillations | | – | | | | Vibrations | | | | | | | | | | | | | | | | | | | |
| – | | | | Mode | | – | | 0 | | – | | 1 | | – | | 2 | | – | | 3 | | – | | 4 | | | | | | | | | |
| – | | | | No. | | – | | Load case | | – | | dry hull | | – | | hyd.mass | | – | | dry hull | | – | | hyd.mass | | | | | | | | | |
| – | | | | 1 | | – | | Full load | | – | | dry hull | | – | | 0.139 | | – | | 0.154 | | – | | 2.269 | | – | | 5.290 | | – | | 8.864 | |
| – | | | | 1 | | – | | Full load | | – | | hyd.mass | | – | | 0.139 | | – | | 0.154 | | – | | 1.751 | | – | | 4.096 | | – | | 6.897 | |
| – | | | | 2 | | – | | Ballast | | – | | dry hull | | – | | 0.149 | | – | | 0.151 | | – | | 2.332 | | – | | 5.614 | | – | | 9.590 | |
| – | | | | 2 | | – | | Ballast | | – | | hyd.mass | | – | | 0.149 | | – | | 0.151 | | – | | 1.793 | | – | | 4.195 | | – | | 7.186 | |

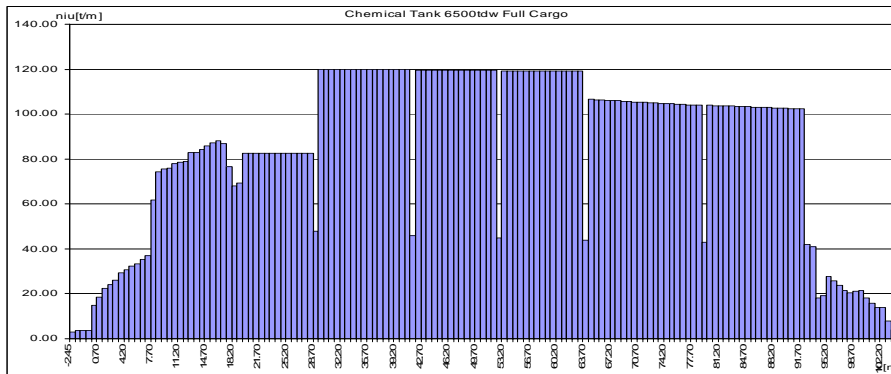


Fig.3.a: The mass diagram at Full Cargo load case, TCH 6500 tdw

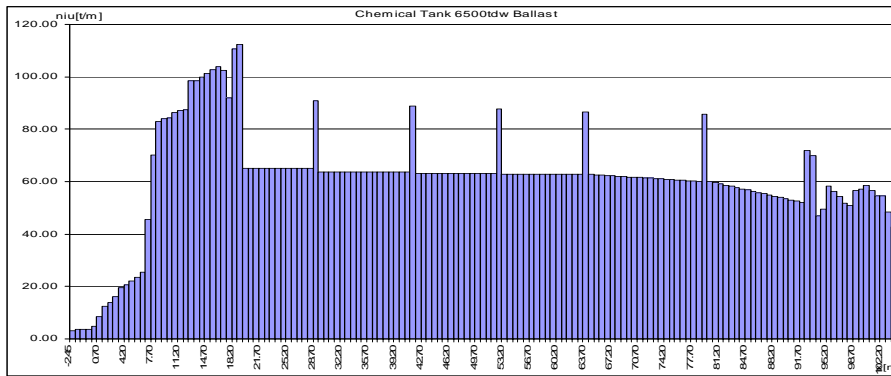


Fig.3.b: The mass diagram at Ballast load case, TCH 6500 tdw

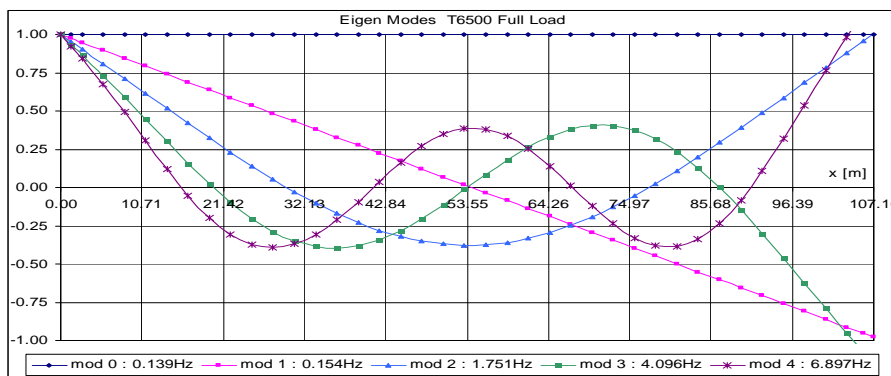


Fig.4: The eigen modes at Full Cargo load case (vib. dry hull), TCH 6500 tdw

4. Numerical analyses of the 6500 tdw chemical tanker ship dynamic response

The numerical analyses are focused on the dynamic loads induced into the ship girder from external waves, under the hydroelasticity hypotheses, for the loading cases of the chemical tanker ship TCH 6500 tdw (table 4), with the input data presented in chapter 3. The dynamic response, with ship motions in vertical plane only, has as reference the equilibrium in still water.

The dynamic analyses are carried on considering as only excitation source the external head waves, with first order power density function type ITTC [6]. It is considered the statistic significant wave height in the domain $h_{1/3}=0-12m$, with step $\delta h_{1/3}=0.5m$, according to the Beaufort scale $B_{level}=1-11$. The time record realisation and the amplitude spectrum for the Longuet-Higgins wave, with first order wave spectrum ITTC $h_{1/3}=8m$, at amidships section $x/L=0.5$, are presented in figs.5.a,b.

This analysis represents a short time prediction of the ship dynamic response, resulting the significant statistical response amplitudes. The numerical analyses are carried on using an eigen software DYN [4],[7],[8] (see chapter 2).

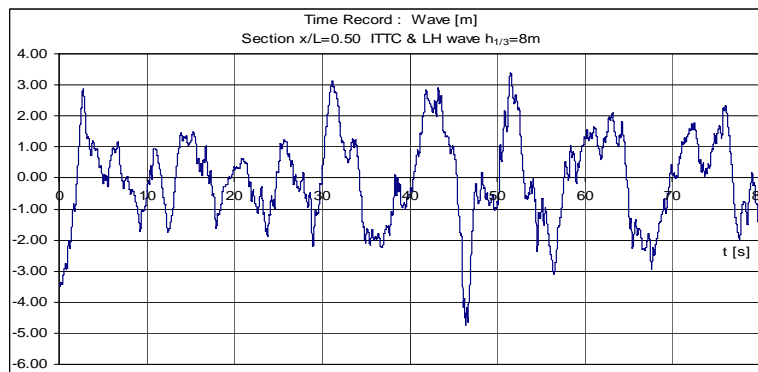


Fig.5.a: The wave L-H time record ($h_{1/3}=8m$, $x/L=0.5$)

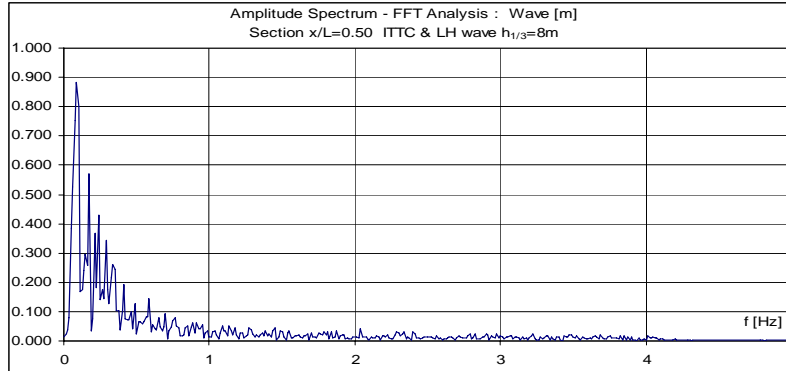


Fig.5.b: The wave L-H amplitude spectrum ($h_{1/3}=8m, x/L=0.5$)

In the following tables are included the numerical results for the chemical tanker ship TCH 6500 tdw dynamic response:

- the ratio between the significant deformation at fundamental eigen vibration mode and the significant vertical displacement at the ship rigid hull oscillations $\%W_{1/3vib}/W_{1/3osc}$, for linear and non-linear dynamic analyses, based on hydroelasticity theory concepts (tables 6.a,b);
- the maximum ratios of the significant bending moments and shearing forces, for fundamental eigen vibration mode and the ship rigid hull oscillations, $\max(\%M_{1/3vib}/M_{1/3osc}, \%T_{1/3vib}/T_{1/3osc})$, for linear and non-linear dynamic analyses, based on hydroelasticity theory concepts (tables 7.a,b);
- the maxim significant normal deck and bottom stresses, the maxim significant tangential neutral axis stresses, equation (8), resulting from maximum significant bending moments and shearing forces, linear and non-linear dynamic responses, added to the still water values, for the longitudinal ship strengths (tables 8.a,b).

$$\sigma_{\max_B,D} = M_{1/3\max}/W_{B,D} \quad \tau_{\max_n-n} = T_{1/3\max} \cdot K_{\tau n-n} \quad (8)$$

Table 6.a: The maxim ratios $\%W_{1/3vib}/W_{1/3osc}$, Full Cargo load, TCH 6500 tdw

| Wave reference $h_{1/3} = 8m$ | | | | $h_{1/3}[m]$ wave height limit | | | |
|-------------------------------|------|-----------------|---------------------|--------------------------------|---------------|-----|-------|
| No | x/L | %vib/osc linear | %vib/osc non-linear | bottom slamming | side slamming | sea | green |
| 1 | 0.00 | 4.60 | 5.08 | > 1.0 | yes | | > 5.0 |
| 2 | 0.25 | 4.56 | 4.80 | | | | |
| 3 | 0.50 | 4.76 | 5.02 | | | | |
| 4 | 0.75 | 4.53 | 4.80 | | | | |
| 5 | 1.00 | 4.57 | 4.88 | > 4.5 | yes | | > 3.5 |
| Average | | 4.60 | 4.92 | | | | |

Table 7.a: The ratios $\max(\%M_{1/3vib}/M_{1/3osc}, \%T_{1/3vib}/T_{1/3osc})$, Full Cargo (wave ref. $h_{1/3}=8m$)

| No | x/L | %vib/osc linear | %vib/osc non-linear | springing | whipping |
|---------|------|-----------------|---------------------|-------------------------|----------|
| 1 | 0.05 | 9.36 | 175.57 | linear: very reduced | high |
| 2 | 0.25 | 9.12 | 218.89 | | |
| 3 | 0.50 | 8.38 | 247.38 | | |
| 4 | 0.75 | 7.76 | 239.54 | | |
| 5 | 0.95 | 7.10 | 123.79 | | |
| Average | | 8.34 | 201.03 | non-linear: reduced | |

Table 8.a: The maxim significant stresses added to still water, Full Cargo, TCH 6500 tdw

| Stress maximum $[N/mm^2]$ | GL _{limit} $[N/m^2]$ | Strength criteria | $h_{1/3}[m]$ limit | Beaufort limit |
|----------------------------------|-------------------------------|-------------------|--------------------|----------------|
| $\sigma_{\max_LIN}+ sw $ deck | 51.7 | 224 | 0.230<1 | 12 |
| $\sigma_{\max_LIN}+ sw $ bottom | 39.6 | 175 | 0.226<1 | 12 |
| $\sigma_{\max_NL}+ sw $ deck | 18.9.1 | 224 | 0.843<1 | 12 |
| $\sigma_{\max_NL}+ sw $ bottom | 14.4.9 | 175 | 0.828<1 | 12 |
| $\tau_{\max_LIN}+ sw $ n-n | 18.9 | 110 | 0.172<1 | 12 |
| $\tau_{\max_NL}+ sw $ n-n | 56.7 | 110 | 0.515<1 | 12 |

Table 6.b: The maxim ratios $\%w_{1/3vib}/w_{1/3osc}$, Ballast load, TCH 6500 tdw

| Wave reference $h_{1/3} = 8m$ | | | | | $h_{1/3}[m]$ wave height limit | | |
|-------------------------------|------|-----------------|---------------------|-----------------|--------------------------------|-----------|--|
| No | x/L | %vib/osc linear | %vib/osc non-linear | bottom slamming | side slamming | green sea | |
| 1 | 0.00 | 6.17 | 6.65 | > 0.0 | yes | > 8.0 | |
| 2 | 0.25 | 6.45 | 6.21 | | | | |
| 3 | 0.50 | 5.18 | 5.11 | | | | |
| 4 | 0.75 | 4.53 | 4.97 | | | | |
| 5 | 1.00 | 4.93 | 5.25 | > 2.5 | yes | > 5.5 | |
| Average | | 5.45 | 5.64 | | | | |

Table 7.b: The ratios $\max(\%M_{1/3vib}/M_{1/3osc}, \%T_{1/3vib}/T_{1/3osc})$, Ballast (wave ref. $h_{1/3}=8m$)

| No | x/L | %vib/osc linear | %vib/osc non-linear | springing | whipping |
|---------|------|-----------------|---------------------|--------------|-----------|
| 1 | 0.05 | 12.33 | 282.57 | linear: | |
| 2 | 0.25 | 9.45 | 274.42 | very reduced | |
| 3 | 0.50 | 8.07 | 316.02 | reduced | very high |
| 4 | 0.75 | 8.73 | 359.04 | | |
| 5 | 0.95 | 7.21 | 257.08 | non-linear: | |
| Average | | 9.16 | 297.83 | reduced | |

Table 8.b: The maxim significant stresses added to still water, Ballast, TCH 6500 tdw

| Stress maximum $[N/mm^2]$ | GL_{limit} $[N/m^2]$ | Strength criteria | $h_{1/3}$ $[m]$ | Beaufort limit |
|---------------------------------|------------------------|-------------------|-----------------|----------------|
| $\sigma_{max_LIN}+ sw $ deck | 88.8 | 224 | 0.396<1 | 12 |
| $\sigma_{max_LIN}+ sw $ bottom | 68.1 | 175 | 0.389<1 | 12 |
| $\sigma_{max_NL}+ sw $ deck | 221.9 | 224 | 0.989<1 | 11 |
| $\sigma_{max_NL}+ sw $ bottom | 170.0 | 175 | 0.972<1 | 11 |
| $\tau_{max_LIN}+ sw $ n-n | 30.1 | 110 | 0.273<1 | 12 |
| $\tau_{max_NL}+ sw $ n-n | 69.6 | 110 | 0.633<1 | 12 |

In the next figures are included the following results:

- the time record simulation (figs.6.a,b) and the amplitude spectrum FFT (figs.7.a,b), for the bending moment at oscillations and vibrations (hydroelasticity), on non-linear analyses, for wave $h_{1/3}=8m$, at section $x/L=0.5$;
- the distribution on the ship length of the normal deck stresses, resulting from the significant bending moments, at ship oscillations and vibrations, non-linear dynamic responses, added to the still water values, for $h_{1/3}=0-12m$ (figs.8.a,b);

In fig.9 it is presented the diagram of the non-dimensional heave damping coefficient λ_{33} , based on Porter&Vugts [2],[6] method, function of the frequency factor δ and the immersion z, at amidships $x/L=0.5$ with:

$$\delta = 36.62 \cdot f^2 \Rightarrow \delta_{osc} = 0.70 - 0.85; \delta_{vib2} = 67 - 116 \quad \delta = (2\pi f)^2 \cdot B_{MLD} / (2 \cdot 9.81) \quad (9)$$

where f [Hz] is the eigen frequencies from table 5 (wet hull). Based on (9) and fig.9, because $\delta_{vib} > 15$, it results that the hydrodynamic damping on vibration components can be considered zero and high for the oscillation modes ($\delta_{osc} < 1$).

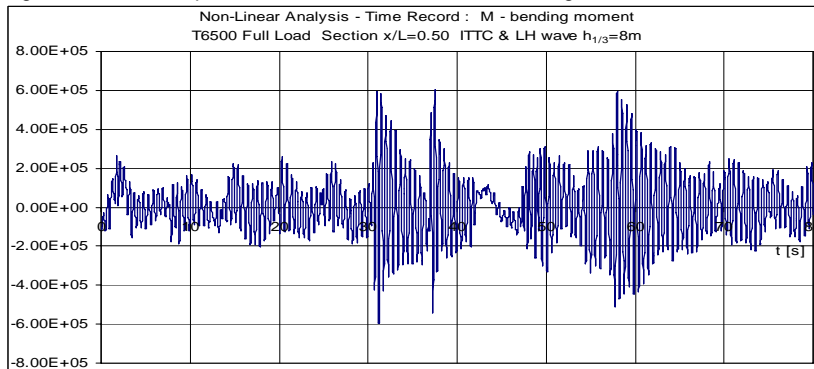


Fig.6.a: Bending moment time record, non-linear analysis, $h_{1/3}=8m$, $x/L=0.5$, Full Cargo load case, Ship TCH 6500 tdw

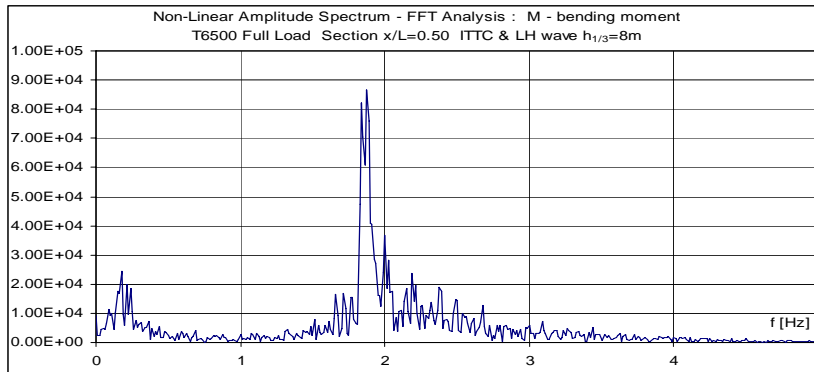


Fig.7.a: Bending moment amplitude spectrum, non-linear, $h_{1/3}=8m$, $x/L=0.5$, Full Cargo load case, Ship TCH 6500 tdw

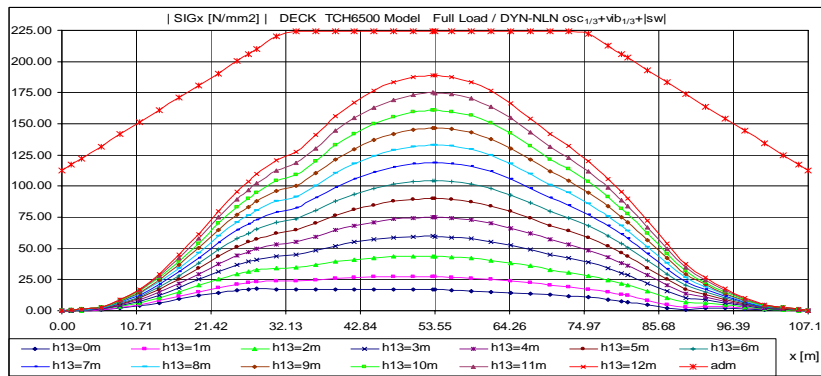


Fig.8.a: Maximum normal deck stress [N/mm²], non-linear, significant + still water, Full Cargo load case, Ship TCH 6500 tdw

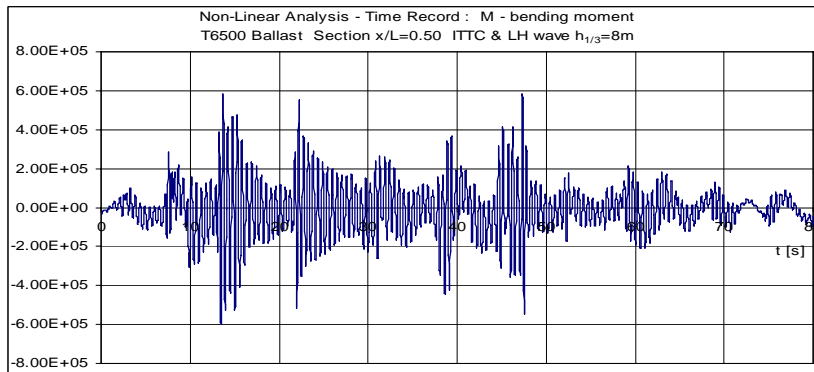


Fig.6.b: Bending moment time record, non-linear analysis, $h_{1/3}=8m$, $x/L=0.5$, Ballast load case, Ship TCH 6500 tdw

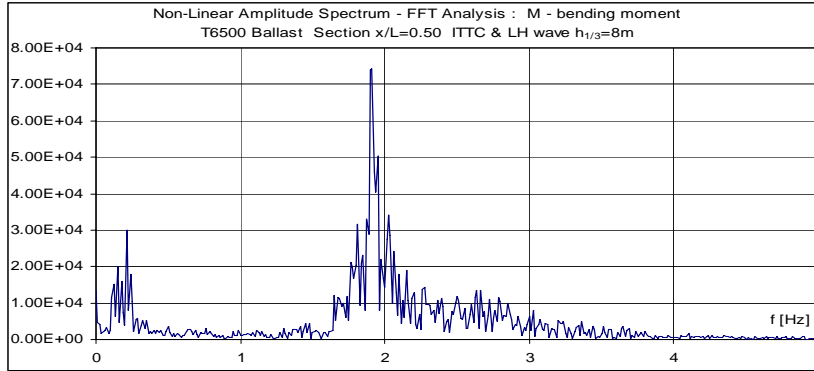


Fig.7.b: Bending moment amplitude spectrum, non-linear, $h_{1/3}=8m$, $x/L=0.5$, Ballast load case, Ship TCH 6500 tdw

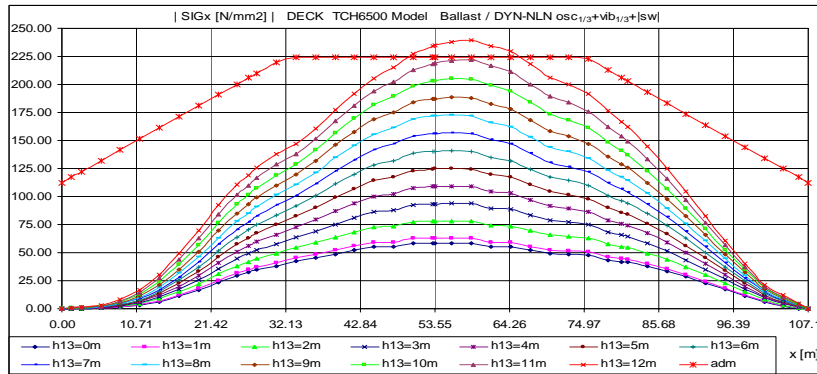


Fig.8.b: Maximum normal deck stress [N/mm²], non-linear, significant + still water, Ballast load case, Ship TCH 6500 tdw

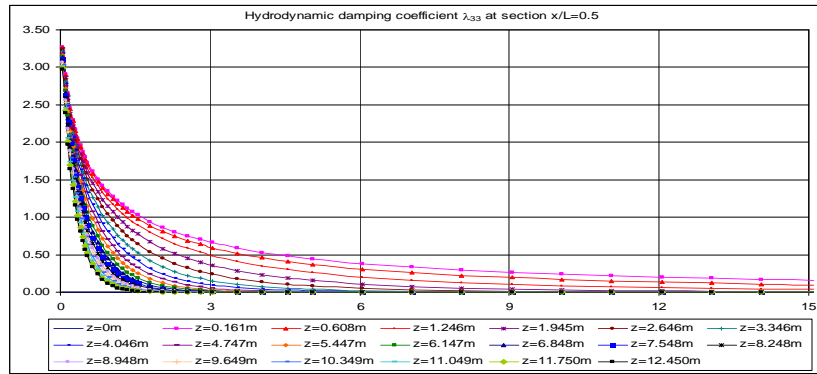


Fig.9 The hydrodynamic damping coefficient λ_{33} ($x/L=0.5$)

5. Conclusions

- The elastic ship girder deformations are small compared to the ship oscillation displacements, 4.60-5.64% (tables 6.a,b), so that the ships motion parameters can be obtained based on ship rigid hull model analyses (standard seakeeping).
- The bottom-slaming phenomenon is produced with very high intensity, for full cargo and ballast loading cases, at both extremities (tables 6.a,b).
- Due to the large amplitude motions and the geometrical non-linearities, with flared shapes at fore and aft peaks, the side slaming can occur in both loading cases (fig.1).
- The linear and non-linear springing phenomena (steady state ship vibrations), have very reduced values on shearing forces and bending moments, less than 14% (tables 7.a,b), because the first eigen vibration frequencies are high 1.75-1.80 > 1 Hz (table 5).
- The whipping phenomenon, the slaming induced transitory vibrations in the ship girder, has high intensity (tables 7.a,b, figs.6-7). The dynamic response on shearing forces and bending moments at the first eigen vibration mode, taking as reference the values on oscillation modes response, is in average 201% at full cargo load case and 298% at ballast load case,

also having significant response values on higher modes. The hydrodynamic and structural damping are very reduced on vibration modes (fig.9, (9), [2]). In this case, because the slamming has a high occurrence, even for low sea states (tables 6.a,b), at both ship extremities (the aft console with small draught and the flared bow with bulb, fig.1), it explains the very high intensity of ship girder whipping dynamic response.

- Based on the non-linear hydroelastic numerical analyses of the dynamic response, it result high stress values in the ship hull structure (tables 8.a,b, figs.8.a,b).
- The numerical results confirm that the linear analyses of the ship dynamic response cannot put in evidence the extreme loads in the ship girder, induced by the slamming and whipping phenomena. It results that the analyses of wave induced dynamic loads in the ship girder must be carried on using the non-linear hydroelasticity theory approach.

Acknowledgments

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SOME EXPERIMENTAL RESULTS IN THE RESEARCHES REGARDING THE NAVAL DIESEL ENGINES RUNNING

Alexandru DRAGALINA¹

Traian FLOREA²

Anastase PRUIU³

Sanda-Ileana DRAGALINA⁴

Traian-Vasile FLOREA⁵

¹ Cdor.prof.univ.dr.ing. Alexandru DRAGALINA - Academia Navală „Mircea cel Bătrân” Constanța

² Prof.univ.dr.ing. Traian FLOREA - Academia Navală „Mircea cel Bătrân” Constanța

³ Prof.univ.dr.ing. Anastase PRUIU - Academia Navală „Mircea cel Bătrân” Constanța

⁴ Lector univ. Sanda-Ileana DRAGALINA - Academia Navală „Mircea cel Bătrân” Constanța

⁵ Ing. Traian-Vasile FLOREA - S.C. Delatreid, Constanța

Abstract: *This paper presents the results of some tests of functional parameters of a naval propulsion engine. The checks were necessary to determine the accuracy of performance on board maintenance, including adjustment of the injection advance angles and cleaning of the exhaust gas spaces.*

Keywords: *engine, diesel, naval, propulsion, running*

1. PRELIMINARY CONSIDERATIONS

In a comprehensive research program, we want to find some solutions for improving the efficiency of naval engines operation. For this purpose, we have been conducted various experimental determinations in the various operational conditions.

In this paper, will be presented a series of items relating to a situation where, while making a long voyage, it was necessary to stop the propulsion engine and to perform some maintenance and repair works.

2. MEASUREMENTS MADE ON THE 11.07.2005 AND 12.07.2005

At this time, between 11.07 and 13.00 LT, it was necessary to stop the main engine, because of overly large pressure variations that occurred in the water circuit of cylinders cooling. To detect the causes that led to this failure, were executed the following control operations:

- have parts the visiting covers of the combustion chambers from cylinders No.7 and No.8;
- were observed water infiltrations in the combustion chamber of the cylinder No.7;
- has parts the cylinder cover of the cylinder No.7;
- have not noticed cracks or deteriorations to the cylinder cover No.7;
- the cylinder liner No.7 shows in the collar area, the entire circumference, aspect of "scorched earth", with irregular vertical cracks in the area of Tb (3 cracks opening of about 4 ... 5 mm).

Due to difficult weather conditions (Sea grade 4 to 5), could not make the cylinder liner replacement. In these circumstances, was taken the decision to operate the engine without cylinder No.7 (with one suspended cylinder). To do this, have executed the following operations:

- has mounted the cylinder cover;
- was suspended the injection from cylinder No.7 (it was decoupled the injection pump);
- have opened the safety valve and the sampling cock from the cylinder No.7;
- has been isolated the cylinder liner cooling circuit;
- was started the main engine with cylinder No.7 suspended.

Continued to march in the crash, until the ship arrived in a secure area for anchorage. Maximum speed at which the engine can operate with a suspended piston shall be calculated with the formula

$$n_1 = n_{nom} \cdot \sqrt{(i-1)/i}, \quad (1)$$

where n_{nom} is the rated engine speed at maximum load, and i - the number of cylinders. Therefore, for MAN K8SZ 70/150CLe, the maximum speed was

$$n_1 = 114 \cdot \sqrt{(8-1)/8} = 106,6 \text{rpm}. \quad (2)$$

At 17.00 LT came into the anchor area and began the work of replacing the cylinder liner No.7. It was considered also the request supply to the first port with a new cylinder liner. The replacement operations were developed in the following order:

- have been isolated the cylinder and piston water cooling circuits;
- has cleared the water;
- were parts the following components of the cylinder cover: injector, high-pressure piping, injector coolant piping, starting air piping, thermocouples for cooling water and exhaust gas temperatures;
- was dismantled the cylinder cover from the engine;
- have attachments parts the nuts of the piston rod and the crosshead;
- to seal parts of the piston rod (stuffing box);
- was extracted the piston from the cylinder liner;
- have parts the cylinder lubricators;
- depression the cylinder liner from the block;
- has been cleaned of the deposits in cooling areas of the block;
- has prepared the reserve cylinder liner;
- was prepared the new sealing gaskets set;
- has pressed the new cylinder liner in the block.

Further, after the cylinder mounting in the block, were performed measurements of the diameters. Determinations were made on two perpendicular directions (Pv-Pp and Bb-Tb), the corresponding position of the piston rings, in PMS (fig.1.a). Results are presented in Table 1 (first part).

Table 1

| <i>Values of measurements</i> | | | | |
|-------------------------------|---------------------------------------|-------|--------|-------|
| Ring channel No. | Cylinder liner diameter [mm] | | | |
| | Pv-Pp | | Bb-Tb | |
| 1 | 699,73 | | 699,72 | |
| 2 | 699,74 | | 699,71 | |
| 3 | 699,67 | | 699,67 | |
| 4 | 699,67 | | 699,66 | |
| 5 | 699,67 | | 699,66 | |
| Ring channel No. | High of the piston ring channels [mm] | | | |
| | Pv | Pp | Bb | Tb |
| 1 | 13,60 | 13,60 | 13,60 | 13,50 |
| 2 | 13,60 | 13,60 | 13,60 | 13,50 |
| 3 | 13,60 | 13,60 | 13,60 | 13,50 |
| 4 | 13,60 | 13,60 | 13,60 | 13,60 |
| 5 | 13,70 | 13,80 | 13,60 | 14,00 |

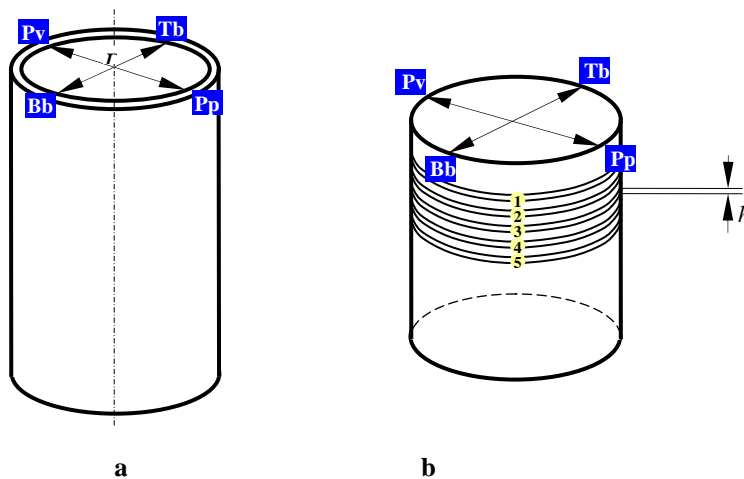


Fig.1 Measurements made at the cylinder liner (a) and at the

- After examining the state of old piston rings, they found that:
- Ring No.1 has good elasticity and can be reused to assembly;
 - Ring No.2 shows reduced elasticity and requires replacement with a new one;
 - Ring No.3 present sharp edges and it is necessary to replace with a new one;
 - Rings No.4 and No.5 have reduced elasticity and pronounced wear, requiring their replacement.

Before mounting, were cleaning the piston, the ring channels and the rings. Were conducted then measured at the ring channels on the piston and have obtained the values shown in Table 1 (second part).

On entering the piston in the new cylinder liner, was imposed the alignment making, by changing the cams position of the crosshead. The values of taken measurements, before and after the alignment, are included in Table 2.

Table 2

| <i>Values of functional clearances</i> | | | | |
|--|---------------------|------|------|------|
| Parameter | Initial values [mm] | | | |
| | Pv | Pp | Bb | Tb |
| The clearance between the piston and the cylinder liner [mm] | 1,20 | 0,25 | 0,65 | 0,70 |
| The clearance in the guide shoe of the crosshead [mm] | 0,15 | 0,05 | 0 | 0,20 |
| Parameter | Final values [mm] | | | |
| | Pv | Pp | Bb | Tb |
| The clearance between the piston and the cylinder liner [mm] | 0,60 | 0,60 | 0,60 | 0,65 |
| The clearance in the guide shoe of the crosshead [mm] | 0,15 | 0,05 | 0 | 0,20 |

3. CONCLUSIONS

Replacement work was completed on 12.07.05 at 06.00 LT. Then passed to the completion with water of the cooling system of cylinders and the engine heating for two hours, until the temperature of cooling water reaches 60°C. After heating, the engine was started, without producing any incident. At 08.15, the engine was ready to maneuver and the ship was able to resume his voyage. The cylinder No.7 operates under the damage, with an additional oil lubrication.

Measured values of the parameters are satisfactory, except for maximum combustion pressures that are too large. In order to reduce the maximum combustion pressure, was imposed the adjustment of the injection advance angles.

It was found, also, that the supercharging pressure in the scavenging air receiver is too small. Has checked the pressure drop of turbocharging air in coolers. After that, has moved to the coolers cleaning, so that pressure drop should not exceed 30 mmH₂O. Table 3 and Figure 2 and 3 are presented the values of functional parameters determined in the two regimes of operation of main engine.

Table 3

Values of functional parameters

| Parameter | Power | Cylinder No. | | | | | | | |
|--|------------------|--------------|-----|-----|-----|-----|-----|-----|-----|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Maximum combustion pressure [bar] | Det.No.1 6184 kW | 96 | 91 | 93 | 95 | 93 | 94 | 96 | 90 |
| | Det.No.2 9096 kW | 111 | 110 | 111 | 109 | 109 | 111 | 113 | 106 |
| Compression pressure [bar] | Det.No.1 6184 kW | 55 | 49 | 49 | 51 | 50 | 52 | 55 | 49 |
| | Det.No.2 9096 kW | 63 | 65 | 62 | 63 | 61 | 65 | 64 | 61 |
| Pressure at the injection moment [bar] | Det.No.1 6184 kW | 68 | 63 | 68 | 66 | 68 | 65 | 65 | 64 |
| | Det.No.2 9096 kW | 83 | 79 | 84 | 77 | 81 | 80 | 82 | 74 |
| Injection advance angle [°RAC] | | 10 | 10 | 9 | 10 | 9 | 10 | 11 | 10 |

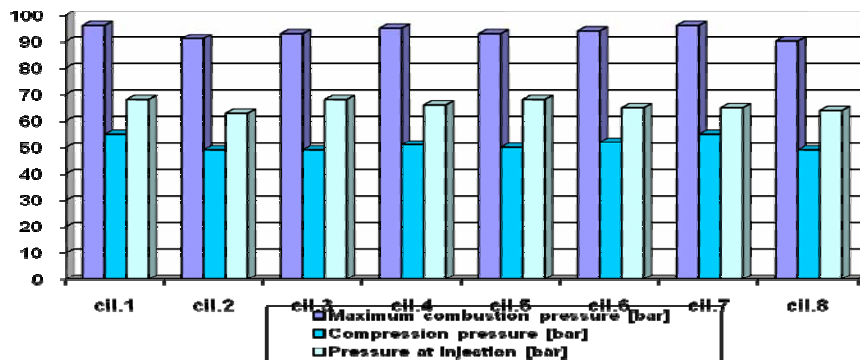


Fig.2. Values of functional parameters in the first determination ($P_e=6184$ kW).

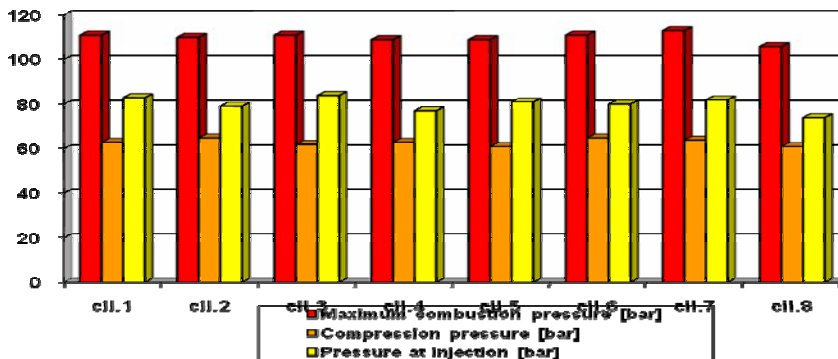


Fig.3. Values of functional parameters in the second determination ($P_e=9096$ kW).

For these parameters were determined the percentage deviations (Table 4), whose dispersions are shown in Figure 4 and 5.

All these results are only a small part of a rich documentary material, which sought to establish how the behavior of a naval engine in various operating conditions. The examinations and the measurements were made during 2005-2008 and led to the proposal of a set of measures aimed at improving the functioning of naval diesel engines with heavy residual fuel.

Table 4

The percentage deviations of some functional parameters

| Percentage deviation of: | | Mean value [bar] | Cylinder No. | | | | | | | |
|---|-----------|------------------|--------------|--------|--------|--------|--------|--------|--------|--------|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| the maximum combustion pressure Δp_{max} [%] | Det. No.1 | 93,5 | +2,674 | -2,674 | -0,535 | +1,604 | -0,535 | +0,535 | +2,674 | -3,743 |
| | Det. No.2 | 110 | +0,909 | 0 | +0,909 | -0,909 | -0,909 | +0,909 | +2,727 | -3,636 |
| the compression pressure Δp_c [%] | Det. No.1 | 51,25 | +7,317 | -4,390 | -4,390 | -0,488 | -2,439 | +1,463 | +7,317 | -4,390 |
| | Det. No.2 | 63 | 0 | +3,175 | -1,587 | 0 | -3,175 | +3,175 | +1,587 | -3,175 |
| the pressure at injection moment Δp_{inj} [%] | Det. No.1 | 65,875 | +3,226 | -4,364 | +3,226 | +0,190 | +3,226 | -1,328 | -1,328 | -2,846 |
| | Det. No.2 | 80 | +3,750 | -1,250 | +5,000 | -3,750 | +1,250 | 0 | +2,50 | -7,500 |

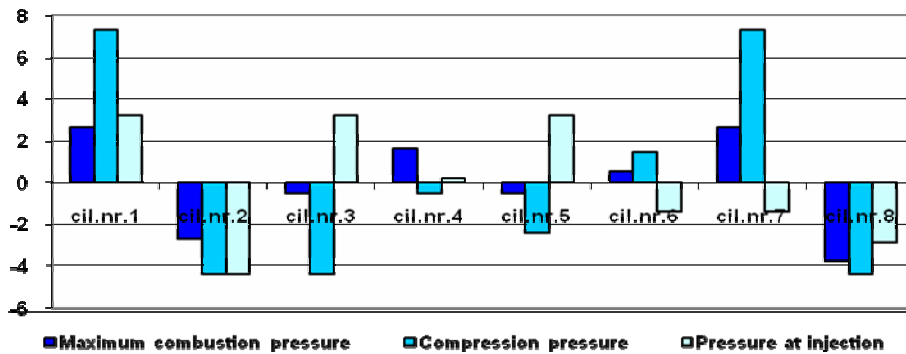


Fig.4. The dispersion of percentage deviations from some functional parameters in the first determination ($P_e=6184$ kW).

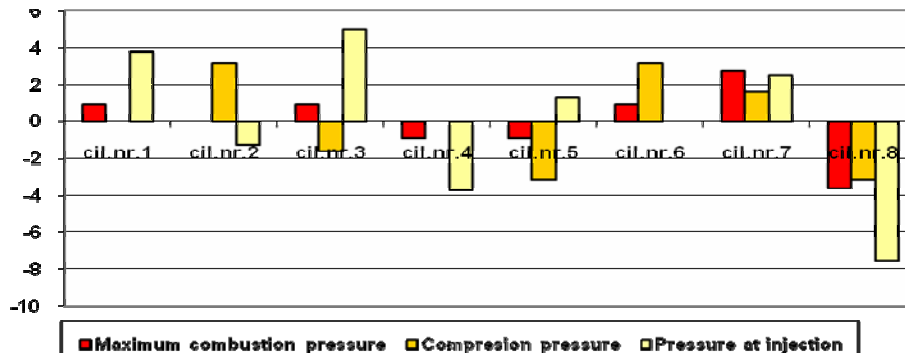


Fig.5. The dispersion of percentage deviations from some functional parameters in the second determination ($P_e=9096$ kW).

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THE STUDY BEHAVIOUR OF MULTISTORY BUILDINGS

Florin EFTIMIE¹

¹ Captain, assistant, Military Technical Academy, Bucharest, Romania

Abstract: This paper presents the seismic response of two category of dual structures: unbracing metallic frames as a result of combination between rigid beam-column nodes and semi-rigid beam-column nodes, and metallic frames with bracing eccentrically openings in combination with unbracing eccentrically openings with rigid nodes.

The metallic multi-storey buildings are in your component composites bridging, whence pull together two different materials. The concrete, it's the plate of bridging and it's heterogeneous material with different behaviour for tension and compressing.

Keywords: Buildings, ductility, unbracing metallic frames, joints

1 GENERALIZATION

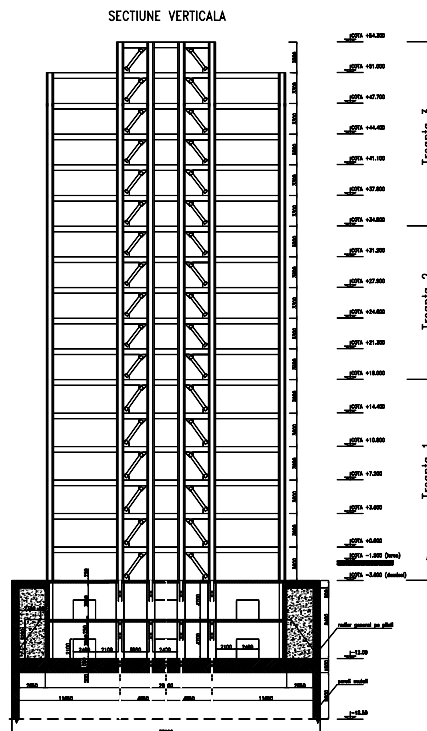
1.1. The constructives elements

The buildings whence be analyses must be foreshaw with two subsoil, one undergroundfloor, groundfloor and 16 floor (with the maximum height 59.7 m) and the destination is for administration office (the face 1).

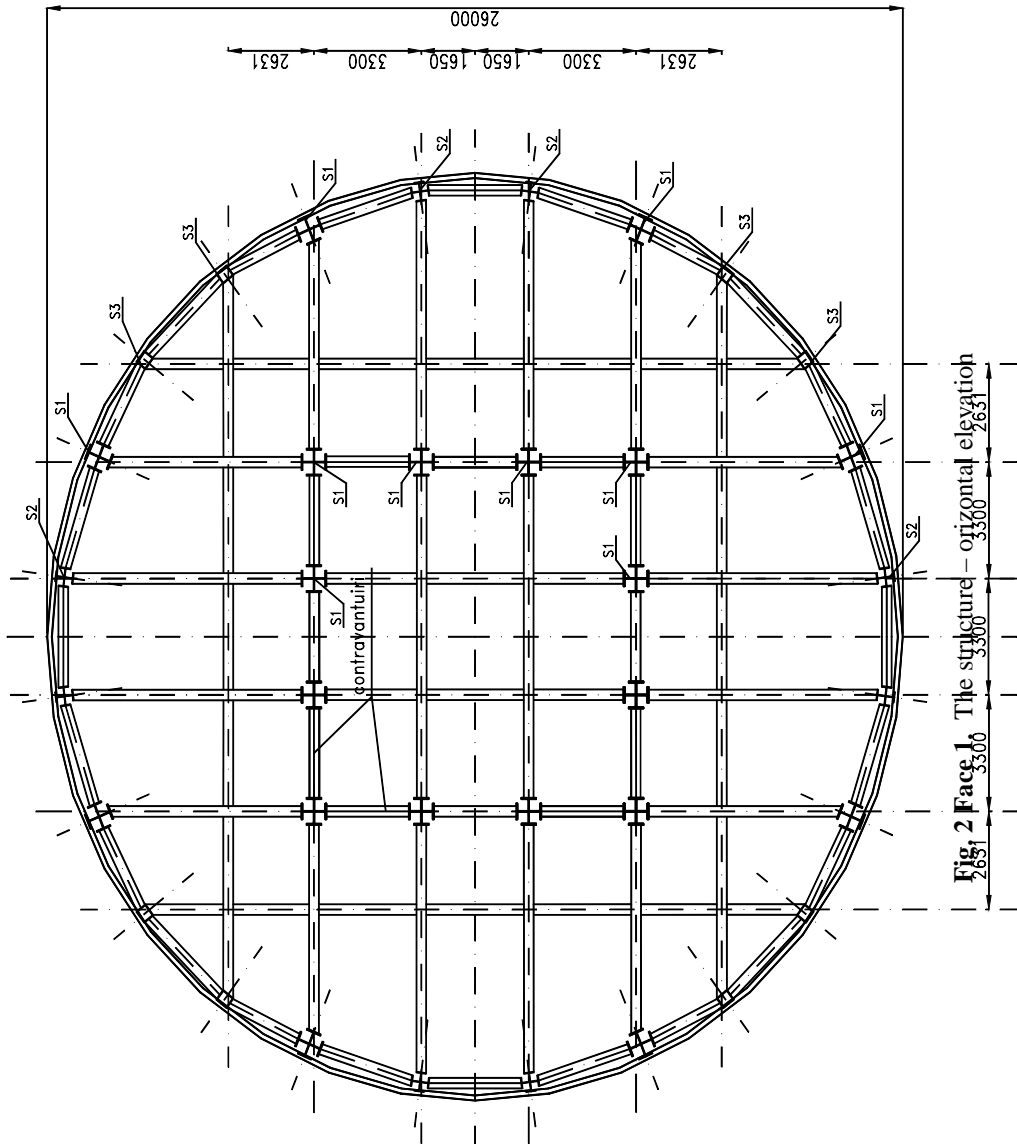
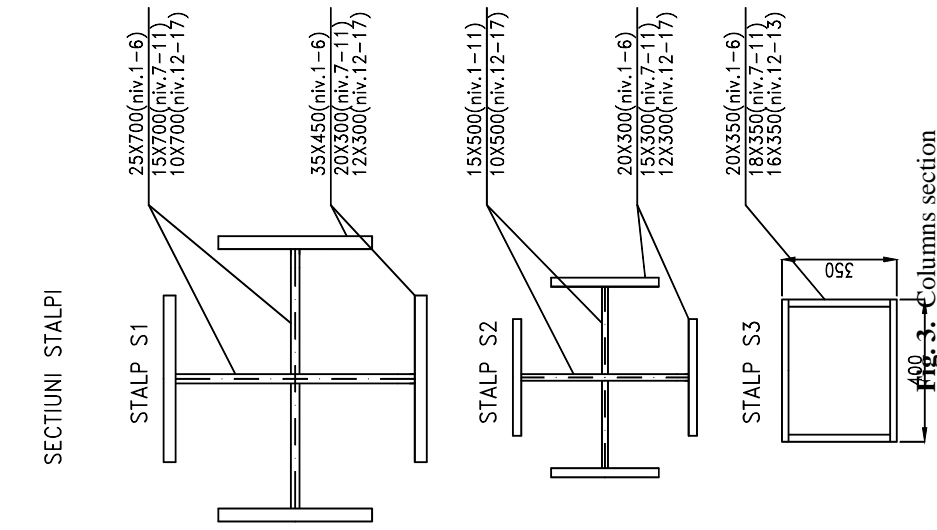
According as the provided destination at the some floor, the height of the floor it's different, the height it's between 3,30 and 4,20m. In the plane, the building is circular, with the diameter 26,00 m (the face 2). At the last three floor, the plans it's different, with the simetry, but the surface it's lesser. The foundations systems it's the solution with the bored pilots and the wall molded, circumjacent. To the higher part of the pilots bear the slab foundation with the thickness 1,50m, into it's constraining the concrete infrastructure. The form in the plan et the functionality imposition the realization for two ortogonales cadres. The vertical structure imposition the realization in the central zone, for the circulation of the elevator and the stairs. This centrale zone it's delimit with the vertical bracing, with two cross bar bound excecetrically to the nodes. In this case on be ralisation four brace cadres, only tow for the two directions. Perimetral, (at the circle circumference), between two brace cadres with the perpendicular orientation on be realization the pendular columns. The secondary beams it's articulate to the columns. The bridging it's with the composite systems, the metallic beams-concrete plane, with metallic connections for the colucration of the material. The columns of the brace cadres are the section in the Malta cross, with the variation in elevation for the structures, with the ticknees of the bottom with the considering of two conditions:

- the height of the columns it's constant in the elevation;
- the class of section it's 1 for all.

The structure it's tested in the teen dimensional and buildings variants.



Face 1. The structure – vertical elevation



1.2. The description of the structural variants

On be tested the some different structures.

On be study the case whence the dissipates bars on be dimensioning for the liniar analyse, grow out of the dissipate bars with the section reduced in raport with the section of the beams for the non bracing cadres, notation with BDSR, in function of the dissipate type of beams. Also, on be studies and the case whence the section of dissipate beam it's the same with the section of beams for the non bracing cadres. In this case, on be noted with the BDSM. The calculus on be realized on the homogeneity structure.

The passage to the real structure with composite beams on be realized usable four constructive solutions:
 the disipate and homogeneous bars (BDSR, BDSM) and the compozites beams with the section of the beams dimensioning in the homogeneous solution, whereat on be added the effect of the concrete slab;
 the disipates and homogeneous bars (BDSR, BDSM) and the composite beams with the section of the beams dimensioning at the last negative capable moment for the composite beams (M_{m+b}^- , expanse the better fibre) must be equal or more in comparision with the plastic moments of the homogeneous beams (M_m);
 the disipates and homogeneous bars and the composites beams, and the section of the metallic beams added with the concrete slab effect;
 the dissipates bars, and the section to the homogeneous bar son be added the effect of the concrete slab and composites equivalent, added with the condition $M_{m+b}^- \geq M_m$.

3. THE DYNAMIC AND NON-LINEAR CALCULATION OF THE STRUCTURES

In face 3 + 11 on be presented the reference values for the application of the dynamic and non-linear calculation of structures. The seismals spectrums used it's Vrancea 1977, El Centro 1940, Northridge 1994 and Mexico City 1995.

3.1. The evaluation of the energetical balance-sheet in the dynamic calculation

For the oscillator with one single degree of liberty the aggregate displacement u_t it's composed by base displacement u_g and relative displacement u :

$$m\ddot{u}_t + c\dot{u} + k(u)u = 0 \quad (2)$$

In the equilibrium equation (2) the rigidity $k(u)$ can be non linear function depend for u .

The equation (2) can be integrated in rapport with displacement u and on be substituted du with $du_t - du_g$ in the first term:

$$\int m\ddot{u}_t (du_t - du_g) + \int c\dot{u} du + \int k(u)u du = 0 \quad (3)$$

consequently :

$$\frac{m\dot{u}_t^2}{2} + \int c\dot{u} du + \int k(u)u du = \int m\ddot{u}_t du_g \quad E_K + E_D + E_A = E_I \quad (4)$$

Whiter E_K it's the absolute kinetic energy, E_A - the energy rapt of the damping, E_D - the energy rapt of the deformation and E_I – input energy. The energy rapt of the deformation can be assimilate with the sum of two type of energy: E_S reclaimable energy (elastic) and non reclaimable E_H ("hysteretic energy") idle $E_D = E_S + E_H$.

In conclusion the energetical balance-sheet it's:

$$E_I = E_K + E_S + E_A + E_H \quad (5)$$

the first two terms represented the elastic energy and the last two terms represent the energy dissipated by the system. The pass to the systems with more degree of liberty is not difficult, and the terms of relation (5) are obtained with some of the masses contribution and the elements registered in the system.

The application ETABS permit the group of elements in “the sets of energy” and accentuate the contribution of the group of elements. For example see the face 11c:

3.1. a. For the seismically spectrum Vrancea 1977 the conclusions it's:

The displacement to the crest of the structures, for all variants, it's between 32cm and 39cm. represented between 64% and 78% for maximum displacement ($\Delta_{adm} = 50$ cm);

The rotation of dissipates bars not get by the plastic rotation admissible for another type of structures;

The cross force to the base of structure it's medium 716,4 tf.

3.1.b. For the seismical spectrum Northridge 1994 the conclusions it's:

- the displacement to the crest of the structures, for all variants, it's between 18cm and 33cm. represented between 36% and 66% for maximum displacement

($\Delta_{adm} = 50$ cm);

- the rotation of dissipates bars at the 5-8 floor it's upper to the plastic rotation admissible;

-the rotation of dissipates bars for another type of structuresnot get by the plastic rotation admissible for another type of structures;

- the cross force to the base of structure it's medium 663,5 tf.

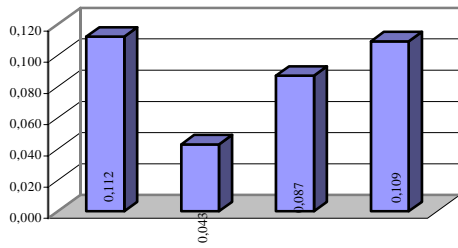
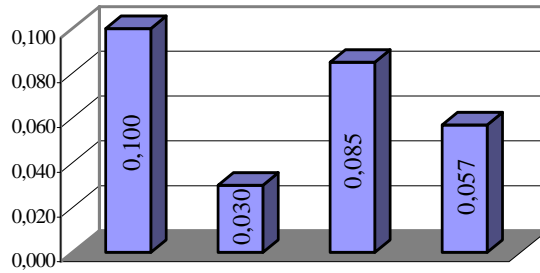


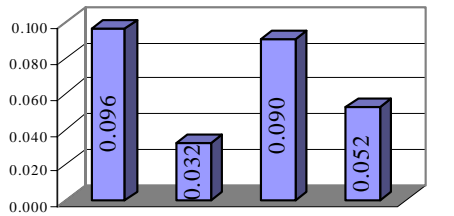
Fig. 4. Non linear and dinamic calc– BDSR 1, T=1.78

Maximum rotation plastic for dissipated bar γ_p



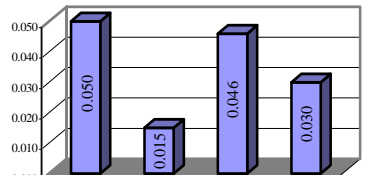
| Location | Date | Acceleration (a) |
|-------------|------------|------------------|
| Vrancea | 4.03.1977 | (a = 0.20 g) |
| El Centro | 18.05.1940 | (a = 0.35 g) |
| Northridge | 17.01.1994 | (a = 0.88 g) |
| Mexico-City | 19.09.1995 | (a = 0.10 g) |

Fig. 5. Non linear and dinamic calc BDSR 2, T=1.50



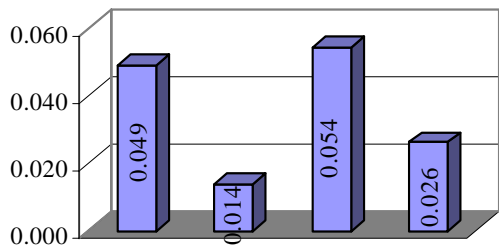
| Location | Date | Acceleration (a) |
|-------------|------------|------------------|
| Vrancea | 4.03.1977 | (a = 0.20 g) |
| El Centro | 18.05.1940 | (a = 0.35 g) |
| Northridge | 17.01.1994 | (a = 0.88 g) |
| Mexico-City | 19.09.1995 | (a = 0.10 g) |

Fig. 6. Non linear and dinamic calc – BDSR 3, T=1.55
 Maximum rotation plastic for dissipated bar γ_p



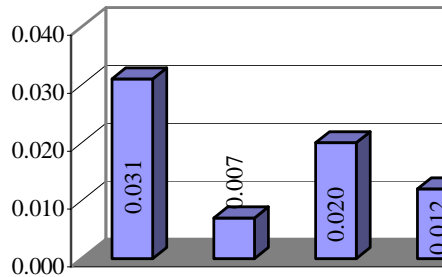
| Location | Date | Acceleration (a) |
|-------------|------------|------------------|
| Vrancea | 4.03.1977 | (a = 0.20 g) |
| El Centro | 18.05.1940 | (a = 0.35 g) |
| Northridge | 17.01.1994 | (a = 0.88 g) |
| Mexico-City | 19.09.1995 | (a = 0.10 g) |

Fig. 7. Calcul dinamic nelinlar – BDSR 4, T=1.55
 Maximum rotation plastic for dissipated bar γ_p



| Location | Date | Acceleration (a) |
|-------------|------------|------------------|
| Vrancea | 4.03.1977 | (a = 0.20 g) |
| El Centro | 18.05.1940 | (a = 0.35 g) |
| Northridge | 17.01.1994 | (a = 0.88 g) |
| Mexico-City | 19.09.1995 | (a = 0.10 g) |

Fig. 8. Non linear and dinamic calc – BDSR 5, T=1.55
 Maximum rotation plastic for dissipated bar γ_p



| Location | Date | Acceleration (a) |
|-------------|------------|------------------|
| Vrancea | 4.03.1977 | (a = 0.20 g) |
| El Centro | 18.05.1940 | (a = 0.35 g) |
| Northridge | 17.01.1994 | (a = 0.88 g) |
| Mexico-City | 19.09.1995 | (a = 0.10 g) |

Fig. 9. Calcul dinamic nelinlar – BDSR 6, T=1.60.
 Maximum rotation plastic for dissipated bar γ_p

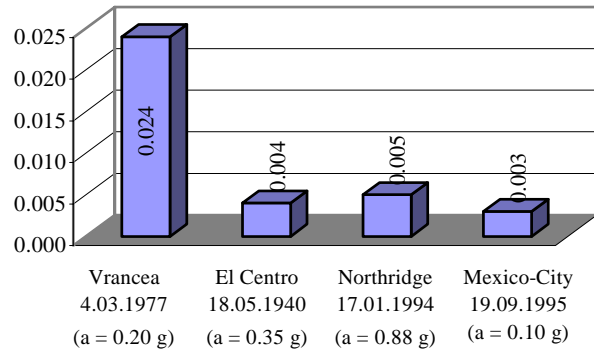


Fig. 10. Non linear and dinamic calc – BDSM 7, $T_1 = 1.35$
 Maximum rotation plastic for dissipated bar γ_p

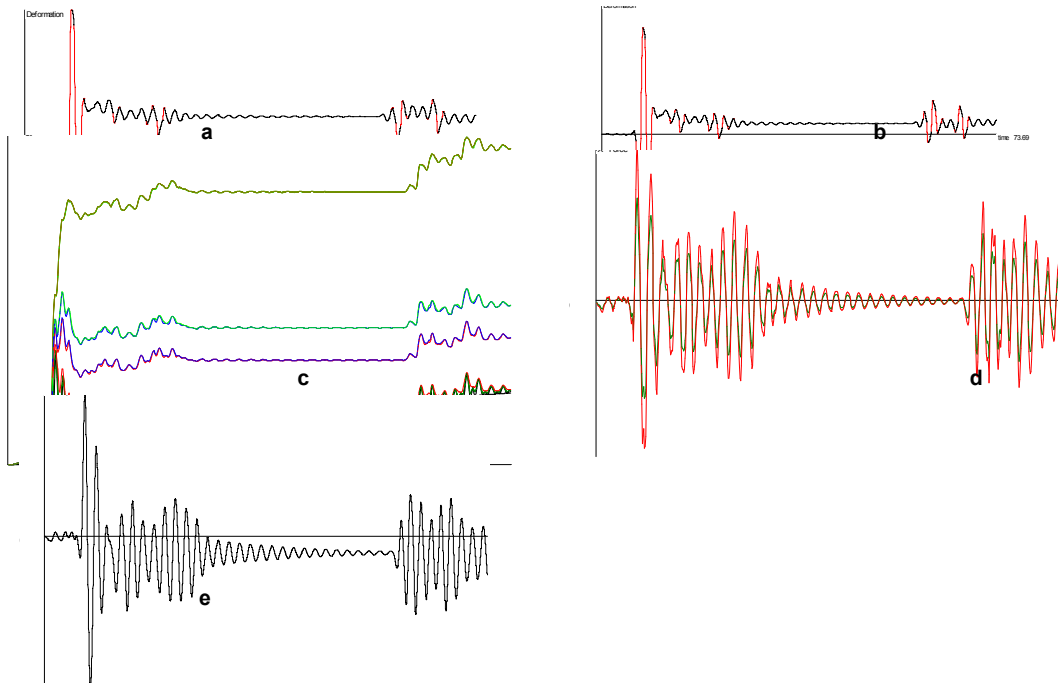
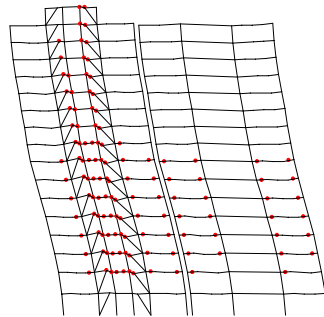


Fig. 11. BDSR – Homogenous solution (tab. 1, nr. 1) Non linear and dynamic calc – spectrum Vrancea 1977 + 30s repaus + spectrum Cheia 1986 (a = 0.08)
 a. rotation of dissipated bar 8: $\gamma_p = 0,112$ rad b rotation of dissipated bar 23: $\gamma_p = 0,092$ rad
 c. the energy dissipated : $E_{max} = 338.4$ tf · m d. cross forcing to the base: $S = 563$ t
 e. the displacement of the node to the last floor (node 236) $\Delta = 0.38$ m

4. CONCLUSIONS

4.1. For conduct the plastic hinges in the dissipate zones it's necessary upper the characteristic geometrical to the end of beams with the bracket or amplifier the bottom of the beams.

4.2. In case the seism, the structures with incursions in the domain elasto-plastic rest with remanence tension and deformation. In the case of the new seism, the structure are new geometry and the dissipates elements with remanence tension can be the concentrator for efforts.

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OPTIMAL REGENERATOR PERFORMANCE IN STIRLING ENGINES

Traian FLOREA¹
Michel FEITH²
Alexandru DRAGALINA³
Traian Vasile FLOREA⁴
Anastase PRUIU⁵
Marian RISTEA⁶
Daniela CHENDRA⁷

¹ Prof. eng. Traian FLOREA Department of Thermal Machines and Devices Naval Academy of Constanta, Romania

² Prof.Ph.D.eng., University Nancy 1, Paris, France

³ PhD Prof. eng. Alexandru DRAGALINA Department of Thermal Machines and Devices Naval Academy of Constanta

⁴ PhD, Eng. Traian Vasile FLOREA Department of Thermal Machines and Devices Naval Academy of Constanta

⁵ Prof. eng. Anastase PRUIU Department of Thermal Machines and Devices Naval Academy of Constanta

⁶ Assist. eng. Marian RISTEA S.C. Delatred S.R.L. Constanta, Romania

⁷ Prof. grad. I. Daniela CHENDRA Ciprian Porumbescu Elementary School, Constanta, Romania

Abstract: The key component of a Stirling engine is its regenerative heat exchanger. This device is subject to losses due to dissipation arising from the flow through the regenerator as well as due to imperfect heat transfer between the regenerator material and the gas. The magnitudes of these losses are characterized by the Stanton number St and the Fanning friction factor f , respectively. Using available data for the ratio St/f , results are found for the Carnot efficiency and the power output of the regenerator. They depend on the conductance and on the ratio of pressures at the two sides of the regenerator. Optimum results for efficiency and power output of the regenerator are derived in the limit of zero Mach number. The results are applied to the Stirling engine. The efficiency and the power output of the engine are found for given amplitude of the compression piston. Optimization with respect to regenerator conductance and piston phase angle leads to a maximum possible value of the power output. Under optimal conditions, the Carnot efficiency just below this maximum is close to 100%.

Key words: regenerative heat exchanger, regenerator, heat engine, Stirling engine, thermal efficiency, Carnot efficiency

1. Introduction

This paper presents a new technique for calculating the efficiency and power of actual operating Stirling machines. This technique is based on the First Law of Thermodynamics for processes with finite speed and is used in conjunction with a new and novel PV / PX diagram and a new method for determining the imperfect regeneration coefficient.

One of the objectives of this paper is to develop the method for determining the imperfect regeneration coefficient X , and to use it for calculating the efficiency and the power output of the Stirling engine.

Initially, the thermal efficiency is written as a function of three basis parameters.

$$\begin{aligned} \eta_{SE} &= \eta_{SE} \cdot \eta_{IIirrev} = \\ &= \eta_{CC} \cdot \eta_{II,irrev,\Delta T} \cdot \Sigma \Delta P_i \end{aligned} \quad (1)$$

where

$$\eta_{CC} = 1 - T_0 / T_{H,S} \quad (2)$$

is the Efficiency of a Carnot cycle operating between the same temperature limits as the Stirling engine.

The second law efficiency

$$\eta_{II,irrev,\Delta T} = 1 / \left(1 + \sqrt{T_0 / T_{H,S}} \right) \quad (3)$$

takes into account the irreversibility due to the temperature difference between the heat source and the gas in the engine. The second law efficiency

$$\eta_{IIirrevX} = \left\{ 1 + X \frac{1 - \sqrt{T_0 / T_{H,S}}}{(\gamma - 1) \ln \varepsilon} \right\}^{-1} \quad (4)$$

takes into account the losses in the regenerator due to incomplete regeneration through use of the coefficient of losses, X . The second law efficiency

$$\eta_{IIirrevX} \cdot \Sigma \Delta P_i = \left[1 - \frac{\Sigma \Delta P_i \cdot \Delta V_i}{\eta' P V_i \sqrt{T_{H,S} / T_0} \cdot \ln \varepsilon} \right]^{-1} \quad (5)$$

with $\eta' = \left(1 - \sqrt{T_0 / T_{H,S}} \right) \cdot \eta_{II,irrev,X}$ takes into account the irreversibility losses due to the pressure drop caused by the finite piston speed. The power output of the engine is

$$\begin{aligned} P_{overSE} &= \eta_{SE} \cdot m R T_{H,g} \cdot \\ &\cdot \ln \varepsilon \cdot (w / 2S), \end{aligned} \quad (6)$$

where ε is the compression ratio, w is piston speed, S is the stroke of the piston, and γ is the specific heat ratio.

A major loss in Stirling engines is caused by incomplete regeneration. An analysis for determining this loss is the primary objective of this paper. A second objective is to make a more realistic analysis of the pressure losses through use of a PV / Px diagram as will be described below (for details, see [11]). Finally, the power and efficiency, as determined by this analysis which involves the computation of X , is compared with performance data taken on twelve actual Stirling engines over a range of operating conditions [7-17].

$$\begin{cases} M = \frac{m_g c_{v,g}}{m_R c_R}; \\ B = (1+M) \frac{h A_R}{m_g c_{v,g}} \cdot \frac{S}{w}. \end{cases} \quad (12)$$

$$h = \frac{0,395 \left(\frac{4P_m}{RT_L} \right) w_g^{0,424} c_P (T_m) \nu (T_m)^{0,576}}{(1-\tau) \left[1 - \frac{\pi}{4[(b/d)-1]} \right] D_R^{0,576} \cdot Pr^{2/3}} \quad (13)$$

with m_g is the mass of the passing through the regenerator, m_R is the mass of the screens of the regenerator, A_R is the surface area of the wires in the regenerator, ν is the viscosity of the working gas, and h is the convective heat transfer coefficient in the regenerator (based on correlation given in [17]).

The sensitivity of X_1 and X_2 to changes in operating variables such as the piston speed was determined. The computed values of X_1 and X_2 were compared with values of X determined from experimental data available in the literature [12-17]. The results based on the theory were found to predict the values from experimental data by using the following equation:

$$X = yX_1 + (1-y)X_2, \quad (14)$$

where y is an adjusting parameter with the value of 0,72.

The loss due to incomplete regeneration as determined through use of eq. (17) is the final loss to be considered in the analysis. The second law efficiency due to irreversibilities from incomplete regeneration is:

4. Comparison of analytic results with the operating performance of actual Stirling engines

The results of computations of efficiency and power output based on this analysis are compared to performance data taken from twelve operating Stirling engines in Figs. 2-3 and in Table I.

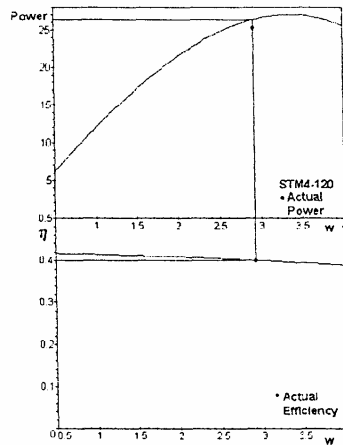


Figure 2. Comparison of the analysis results with actual performance data for the STM4-120 Stirling engine [27]

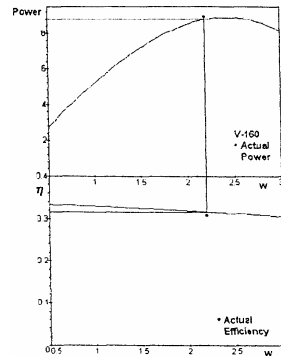


Figure 3. Comparison of the analysis results with actual performance data for the V-160 Stirling engine [27]

Table 1. Comparison between the analytical results and actual engine performance data [1-14]

| Stirling Engine | Actual Power [kW] | Calculated Power [kW] | Actual Efficiency | Calculated Efficiency |
|-------------------------------|--------------------------|------------------------------|--------------------------|------------------------------|
| NS-03M, regime 1 (economy) | 2.03 | 2.182 | 0.359 | 0.3392 |
| NS-03M, regime 1 (max. power) | 3.81 | 4.196 | 0.31 | 0.3297 |
| NS-03T, regime 1 (economy) | 3.08 | 3.145 | 0.326 | 0.3189 |
| NS-03T, regime 1 (max. power) | 4.14 | 4.45 | 0.303 | 0.3096 |
| NS-30A, regime 1 (economy) | 23.2 | 29.45 | 0.375 | 0.357 |
| NS-30A, regime 1 (max. power) | 30.4 | 33.82 | 0.33 | 0.3366 |
| NS-30S, regime 1 (economy) | 30.9 | 33.78 | 0.372 | 0.366 |
| NS-30S, regime 1 (max. power) | 45.6 | 45.62 | 0.352 | 0.3526 |
| STM4-120 | 25 | 26.36 | 0.4 | 0.4014 |
| V-160 | 9 | 8.825 | 0.3 | 0.308 |
| 4-95 MKII | 25 | 28.4 | 0.294 | 0.289 |
| 4 – 275 | 50 | 48.61 | 0.42 | 0.4119 |
| GPU-3 | 3.96 | 4.16 | 0.127 | 0.1263 |
| MP1002 CA | 200W | 193.9W | 0.156 | 0.1536 |
| Free Piston Stirling Engine | 9 | 9.165 | 0.33 | 0.331 |
| RE-1000 | 0.939 | 1.005 | 0.258 | 0.2285 |

This figures show that there is high degree of correlation between this analysis and the operational data. This indicates that this analysis can be used to accurately calculate X and of other losses. Therefore, this analysis can be used to accurately predicting Stirling engine performance under a wide range of conditions. This capability should be of considerable value in Stirling engine design and in the prediction the performance of a particular Stirling engine over a range of operating speed.

The strong correlation between the analytical results and actual engine performance data also indicates that the Direct Method of using the first law for processes with finite speed is a valid method of analysis for irreversible cycles.

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CALCULATION OF INDUCTIVITIES BY MEANS OF SYMBOLIC METHODS

Gheorghe GAVRILĂ¹
Florin-Roman ENACHE²

¹ Professor, PhD, Military Technical Academy

² Lecturer professor, PhD, Military Technical Academy

Abstract: In the designing and realization of the electromagnetic devices, an important problem is represented by the self and mutual inductivities calculation.

There are many methods which can be used for this, as it follows: direct method, the calculation by means of the reluctance (when the coils are placed on the magnetic circuits), utilizing Neumann's formula and the calculation on basis of the energetic definition of the inductivity.

Even in the case of linear magnetic media, the problem is not simple, because it is necessary to calculate the magnetic flux density as accurate as possible, in a lot of points from space.

An adequate method for this purpose is the utilization of the symbolic methods with MAPLE simulator.

After some theoretical considerations, in the paper a few applications relating to self and mutual inductivities calculation are presented. The obtained results are discussed, pointing out the advantages of the symbolic methods: fast calculation, but without the loss of the physical meaning of the problem.

Keywords: Self-inductivity, mutual inductivity, Neumann's formula, symbolic methods

1. SELF-INDUCTIVITY

It is considered a filamentary conductor turn of contour Γ , crossed by electrical current, placed in a isotropic, linear an homogeneous medium, of magnetic permeability $\mu = \text{const.}$ (**fig. 1**).

It is called *self-inductivity* the positive ratio between magnetic flux Φ_{S_Γ} through any open surface S_Γ , which is based on the closed curve Γ and current I :

$$L = \frac{\Phi_{S_\Gamma}}{I} > 0. \quad (1)$$

If the magnetic flux is expressed by:

$$\Phi_{S_\Gamma} = \iint_{S_\Gamma} \vec{B} \cdot \vec{n} \, dA, \quad (2)$$

where magnetic flux density \vec{B} in a point placed on S_Γ it is calculated with *Biot-Savart-Laplace's* formula:

$$\vec{B} = \frac{\mu I}{4\pi} \iint_{\Gamma} \frac{d\vec{\ell} \times \vec{R}}{R^3}, \quad (3)$$

for Φ_{S_Γ} results the relation:

$$\Phi_{S_\Gamma} = \frac{\mu I}{4\pi} \iint_{S_\Gamma} \vec{n} \, dA \iint_{\Gamma} \frac{d\vec{\ell} \times \vec{R}}{R^3}. \quad (4)$$

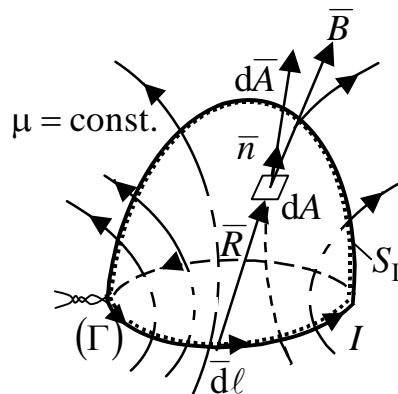


Fig. 1. Relating to self-inductivity definition

Replacing (4) in (1), it is obtained for the self-inductivity the following relation:

$$L = \frac{\mu}{4\pi} \iint_{S_\Gamma} \vec{n} \, dA \iint_{\Gamma} \frac{d\vec{\ell} \times \vec{R}}{R^3}, \quad (5)$$

which shows that the self-inductivity L is independent of the magnetic flux and of the electrical current, depending only on the turn shape and dimensions, respectively of the magnetic permeability μ .

The expression (5) represents *the self-inductivity of a turn*. In the case of a coil with N turns, the magnetic flux is *the flux linking a coil* $\Phi_{fS_\Gamma} = N\Phi_{fS_\Gamma}$ (where Φ_{fS_Γ} is the *flux linking a turn*), and it is established by the magnetic flux density:

$$\vec{B} = \frac{\mu NI}{4\pi} \oint_{\Gamma} \frac{d\vec{\ell} \times \vec{R}}{R^3}. \quad (6)$$

Therefore, *the self-inductivity of a coil with N turns* has the expression:

$$L = \frac{\Phi_{fS_\Gamma}}{I} = \frac{N\Phi_{fS_\Gamma}}{I} = \frac{\mu N^2}{4\pi} \iint_{S_\Gamma} \vec{n} \cdot d\vec{A} \oint_{\Gamma} \frac{d\vec{\ell} \times \vec{R}}{R^3}, \quad (7)$$

being proportional to the square of the turns number.

2. MUTUAL INDUCTIVITY. NEUMANN'S FORMULA

Two coils ① and ②, realized from filamentary conductors, are considered. The coils, having N_1 , respectively N_2 turns, are held in the same relative position and are placed in a medium with constant magnetic permeability, $\mu = \text{const.}$ (**fig. 2.** – for the simplification of the drawing, in figure it is represented only a single turn for each coil).

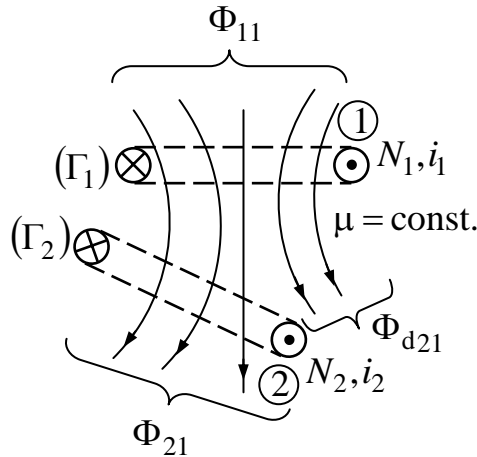


Fig. 2. Relating to mutual inductivity definition

It is called *mutual inductivity L_{21} between coils ① and ②*, the ratio between flux linking a coil Φ_{21} , produced by the electrical current i_1 , which crosses the coil ①, through the coil ②, and the electric current i_1 (the current through the coil ② being null $i_2 = 0$):

$$L_{21} = \left. \frac{\Phi_{21}}{i_1} \right|_{i_2=0} = N_2 \left. \frac{\Phi_{f_{21}}}{i_1} \right|_{i_2=0} \leq 0. \quad (8)$$

Similarly it is defined the mutual inductivity L_{12} between coils ② and ① (in this case, $i_1 = 0$):

$$L_{12} = \left. \frac{\Phi_{12}}{i_2} \right|_{i_1=0} = N_1 \left. \frac{\Phi_{f_{12}}}{i_2} \right|_{i_1=0} \leq 0. \quad (9)$$

The mutual inductivity is *positive* or *negative*, as the reference directions of the contours Γ_1 and Γ_2 are associated after the right spiral screw tap rule, in the same direction or in opposite direction.

Taking into account that $\vec{B} = \text{rot } \vec{A}$, where \vec{A} is vector magnetic potential, the flux linking a turn $\Phi_{f_{21}}$ through the coil of the contour Γ_2 , established by the electrical current i_1 through the coil of the contour Γ_1 , can be written as it follows:

$$\Phi_{f_{21}} = \iint_{S_{\Gamma_2}} \vec{B}_1 \cdot \vec{n}_2 d\sigma_2 = \iint_{S_{\Gamma_2}} \text{rot } \vec{A}_1 \cdot \vec{n}_2 d\sigma_2 = \oint_{\Gamma_2} \vec{A}_1 \cdot d\vec{\ell}_2, \quad (10)$$

where the area element is noted with $d\sigma$ instead of dA , and with $\overline{d\ell}_2$ is noted the length element on the contour Γ_2 .

The vector magnetic potential \overline{A}_1 , produced by the electrical current i_1 , is calculated with formula

$\overline{A}(\overline{r}) = \frac{\mu i}{4\pi} \int_{\Gamma} \frac{\overline{d\ell}}{R}$, taking into account that it is a coil with N_1 turns. Therefore:

$$\overline{A}_1 = \mu \frac{N_1 i_1}{4\pi} \int_{\Gamma_1} \frac{\overline{d\ell}_1}{R_{12}}, \quad (11)$$

where $\overline{d\ell}_1$ is length element on the contour Γ_1 , and $R_{12} = |\overline{R}_{12}|$, in which \overline{R}_{12} is the vector which joins the length elements $\overline{d\ell}_1$ and $\overline{d\ell}_2$.

Taking into account that $\Phi_{21} = N_2 \Phi_{f21}$ and replacing (11) in (10), results:

$$\Phi_{21} = \frac{\mu N_1 N_2 i_1}{4\pi} \int_{\Gamma_1} \int_{\Gamma_2} \frac{\overline{d\ell}_1 \cdot \overline{d\ell}_2}{R_{12}}. \quad (12)$$

Replacing relation (12) in (8) it follows:

$$L_{21} = \frac{\mu N_1 N_2}{4\pi} \int_{\Gamma_1} \int_{\Gamma_2} \frac{\overline{d\ell}_1 \cdot \overline{d\ell}_2}{R_{12}}. \quad (13)$$

Similarly in the case of the relation (9), it results:

$$L_{12} = \frac{\mu N_2 N_1}{4\pi} \int_{\Gamma_2} \int_{\Gamma_1} \frac{\overline{d\ell}_2 \cdot \overline{d\ell}_1}{R_{21}}. \quad (14)$$

The mutual inductivity is noted with M .

The relation (13) or (14) represents *the Neumann's formula for mutual inductivities*.

3. SYMBOLIC CALCULATION OF THE INDUCTIVITIES

In this section it is presented the symbolic calculation of the self and mutual inductivities with different shapes, by means of MAPLE program. The computation methods are those which have been presented in previous sections.

3.1. Self inductivity for a straight circular turn

In this subsection it is presented the self-inductivity computation for a straight circular turn with radius a , made from a round filamentary conductor with radius b and placed in the air (**fig. 3**). Numerical application: $a = 40$ cm, $b = 5$ mm, air magnetic permeability $\mu_0 = 4\pi \cdot 10^{-7}$ H/m.

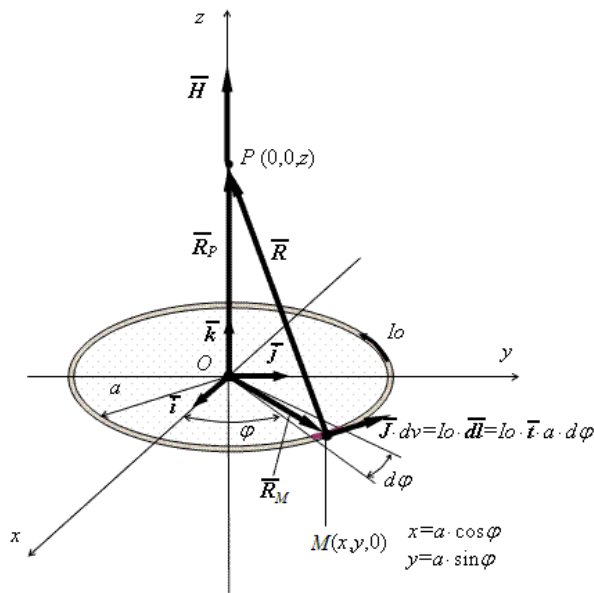


Fig. 3. Relating to self-inductivity computation for a straight circular turn

For the computation of the self-inductivity, the relation (4) has been utilized. The MAPLE code for this calculation it is presented in the following table:

Table 1

```
> restart: with(plots): with(linalg): with(plottools):
> e[r]:=vector([1,0,0]): e[phi]:=vector([0,1,0]): k:=vector([0,0,1]):
> Rp:=r*e[r]+z*k:Rm:=a*cos(phi)*e[r]-a*sin(phi)*e[phi]:
> Rp:=evalm(Rp):Rm:=evalm(Rm): R:=Rp-Rm: R:=evalm(R):
> Rmod:=simplify(sqrt(R[1]^2+R[2]^2+R[3]^2)):
> ds:=a*sin(phi)*e[r]+a*cos(phi)*e[phi]: ds:=evalm(ds):
> A:=mu*Io/(4*Pi)*Int(ds/Rmod,phi=0..2*Pi):A:=evalm(A):
> Ar:=dotprod(A,e[r]): Aphi:=dotprod(A,e[phi]): Az:=dotprod(A,k):
> Ar:=value(Ar): Aphi:=value(Aphi): Az:=value(Az):
```

$A_r := 0$

$$A_{\phi} := \frac{1}{2} \mu I_0 \sqrt{\frac{r^2 + z^2 + a^2 - 2ra}{r^2 + z^2 + a^2 + 2ra}} \left(r^2 \operatorname{EllipticK} \left(2 \sqrt{\frac{ra}{r^2 + z^2 + a^2 + 2ra}} \right) - 2ra \operatorname{EllipticE} \left(2 \sqrt{\frac{ra}{r^2 + z^2 + a^2 + 2ra}} \right) - a^2 \operatorname{EllipticE} \left(2 \sqrt{\frac{ra}{r^2 + z^2 + a^2 + 2ra}} \right) - r^2 \operatorname{EllipticE} \left(2 \sqrt{\frac{ra}{r^2 + z^2 + a^2 + 2ra}} \right) + a^2 \operatorname{EllipticK} \left(2 \sqrt{\frac{ra}{r^2 + z^2 + a^2 + 2ra}} \right) - z^2 \operatorname{EllipticE} \left(2 \sqrt{\frac{ra}{r^2 + z^2 + a^2 + 2ra}} \right) + z^2 \operatorname{EllipticK} \left(2 \sqrt{\frac{ra}{r^2 + z^2 + a^2 + 2ra}} \right) \right) / (\pi r \sqrt{r^2 + z^2 + a^2 - 2ra})$$

$A_z := 0$

```
> Phi:=int(subs(z=0,r=a-b,Aphi)*(a-b),phi=0..2*Pi);
```

$$\Phi := 2 \left(\frac{1}{2} \mu I_0 \sqrt{\frac{(a-b)^2 + a^2 - 2(a-b)a}{(a-b)^2 + a^2 + 2(a-b)a}} (-2(a-b)a - a^2 - (a-b)^2) \operatorname{EllipticE} \left(2 \sqrt{\frac{(a-b)a}{(a-b)^2 + a^2 + 2(a-b)a}} \right) / (\pi(a-b)) \sqrt{(a-b)^2 + a^2 - 2(a-b)a} + \frac{1}{2} \mu I_0 \sqrt{\frac{(a-b)^2 + a^2 - 2(a-b)a}{(a-b)^2 + a^2 + 2(a-b)a}} ((a-b)^2 + a^2) \operatorname{EllipticK} \left(2 \sqrt{\frac{(a-b)a}{(a-b)^2 + a^2 + 2(a-b)a}} \right) / (\pi(a-b)) \sqrt{(a-b)^2 + a^2 - 2(a-b)a} \right) (a-b) \pi$$

```
> L:=simplify(Phi/Io);
```

$$L := -\mu \sqrt{\frac{b^2}{(2a-b)^2}} \operatorname{csgn}(b) \left(4 \operatorname{EllipticE} \left(2 \sqrt{\frac{(a-b)a}{(2a-b)^2}} \right) a^2 - 4 \operatorname{EllipticE} \left(2 \sqrt{\frac{(a-b)a}{(2a-b)^2}} \right) ab + \operatorname{EllipticE} \left(2 \sqrt{\frac{(a-b)a}{(2a-b)^2}} \right) b^2 \right)$$

$$- 2 \operatorname{EllipticK}\left(2 \sqrt{\frac{(a-b)a}{(2a-b)^2}}\right) a^2 + 2 \operatorname{EllipticK}\left(2 \sqrt{\frac{(a-b)a}{(2a-b)^2}}\right) a b$$

$$- \operatorname{EllipticK}\left(2 \sqrt{\frac{(a-b)a}{(2a-b)^2}}\right) b^2 \Big/ b$$

> mu0:=4*Pi*10^(-7);a0:=0.04;b0:=0.0005;

$$\mu_0 := \frac{\pi}{2500000} \quad a_0 := 0.04 \quad b_0 := 0.0005$$

> L0:=evalf(subs(mu=mu0,a=a0,b=b0,L));

$$L_0 := 0.2225466124 \cdot 10^{-6}$$

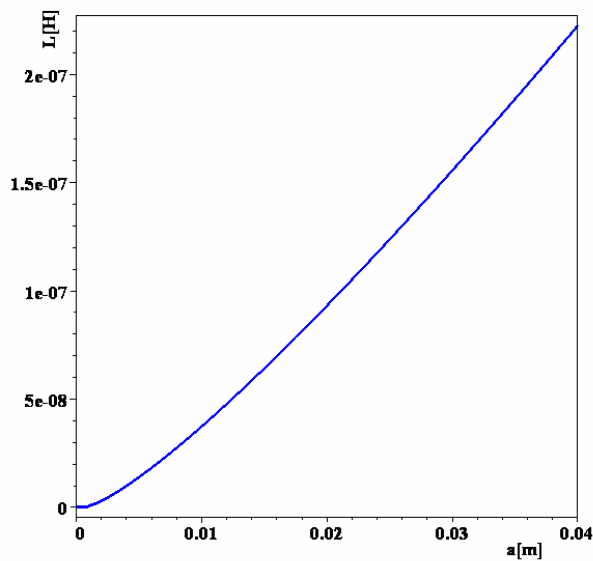


Fig. 4. Variation of self-inductivity with a radius

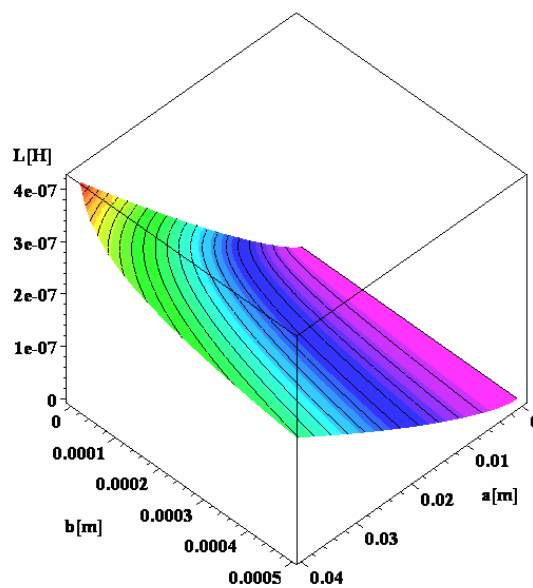


Fig. 5. Variation of self-inductivity with a and b

3.2. Mutual inductivity between two coaxial straight circular turns

In this subsection it is presented the mutual inductivity computation for two coaxial straight circular turns with a and b radii, placed in air at the distance d , in the parallel planes (fig. 6). Numerical application: $a=5$ cm, $b=2$ cm, $h=5$ cm, air magnetic permeability $\mu_0 = 4\pi \cdot 10^{-7}$ H/m .

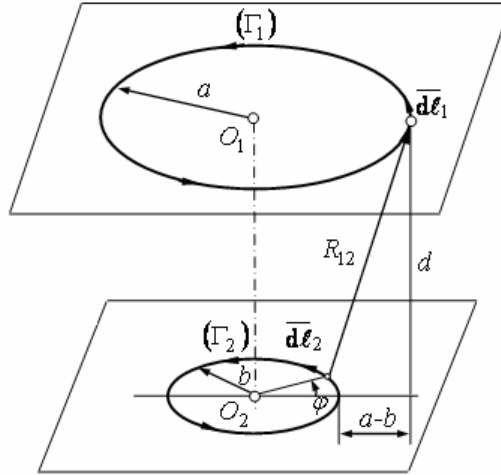


Fig. 6. Relating to mutual inductivity computation between two coaxial straight circular turns

For the computation of the mutual inductivity, the relation (14) has been utilized. The MAPLE code for this calculation it is presented in the following table:

Table 2.

```
> restart: with(plots):with(linalg):with(plottools):
> er:=vector([1,0,0]):ephi:=vector([0,1,0]): k:=vector([0,0,1]):
> Rp:=r*er+z*k:Rm:=a*cos(phi)*er-a*sin(phi)*ephi:
> Rp:=evalm(Rp):Rm:=evalm(Rm): R:=Rp-Rm: R:=evalm(R):
> Rmod:=simplify(sqrt(R[1]^2+R[2]^2+R[3]^2)):
> ds:=a*sin(phi)*er+a*cos(phi)*ephi: ds:=evalm(ds):
> A:=mu*Io/(4*Pi)*Int(ds/Rmod,phi=0..2*Pi):A:=evalm(A):
> Ar:=dotprod(A,er): Aphi:=dotprod(A,ephi): Az:=dotprod(A,k):
> Ar:=value(Ar): Aphi:=value(Aphi): Az:=value(Az):
Ar := 0
```

$$A_{phi} := \frac{1}{2} \mu I_0 \sqrt{\frac{r^2 + z^2 + a^2 - 2ra}{r^2 + z^2 + a^2 + 2ra}} \left(r^2 \text{EllipticK}\left(2 \sqrt{\frac{ra}{r^2 + z^2 + a^2 + 2ra}}\right) - 2ra \text{EllipticE}\left(2 \sqrt{\frac{ra}{r^2 + z^2 + a^2 + 2ra}}\right) - a^2 \text{EllipticE}\left(2 \sqrt{\frac{ra}{r^2 + z^2 + a^2 + 2ra}}\right) - r^2 \text{EllipticE}\left(2 \sqrt{\frac{ra}{r^2 + z^2 + a^2 + 2ra}}\right) + a^2 \text{EllipticK}\left(2 \sqrt{\frac{ra}{r^2 + z^2 + a^2 + 2ra}}\right) - z^2 \text{EllipticE}\left(2 \sqrt{\frac{ra}{r^2 + z^2 + a^2 + 2ra}}\right) + z^2 \text{EllipticK}\left(2 \sqrt{\frac{ra}{r^2 + z^2 + a^2 + 2ra}}\right) \right) / (\pi r \sqrt{r^2 + z^2 + a^2 - 2ra})$$

$A_z := 0$

```
> Phi:=int(subs(r=b,z=d,Aphi)*b,phi=0..2*Pi):
> M:=Phi/Io;
```

$$\begin{aligned}
 M := & \mu \sqrt{\frac{b^2 + d^2 + a^2 - 2 b a}{b^2 + d^2 + a^2 + 2 b a}} \left(b^2 \text{EllipticK}\left(2 \sqrt{\frac{b a}{b^2 + d^2 + a^2 + 2 b a}}\right) \right. \\
 & - 2 b a \text{EllipticE}\left(2 \sqrt{\frac{b a}{b^2 + d^2 + a^2 + 2 b a}}\right) \\
 & - a^2 \text{EllipticE}\left(2 \sqrt{\frac{b a}{b^2 + d^2 + a^2 + 2 b a}}\right) - b^2 \text{EllipticE}\left(2 \sqrt{\frac{b a}{b^2 + d^2 + a^2 + 2 b a}}\right) \\
 & + a^2 \text{EllipticK}\left(2 \sqrt{\frac{b a}{b^2 + d^2 + a^2 + 2 b a}}\right) - d^2 \text{EllipticE}\left(2 \sqrt{\frac{b a}{b^2 + d^2 + a^2 + 2 b a}}\right) \\
 & \left. + d^2 \text{EllipticK}\left(2 \sqrt{\frac{b a}{b^2 + d^2 + a^2 + 2 b a}}\right) \right) / \sqrt{b^2 + d^2 + a^2 - 2 b a}
 \end{aligned}$$

> mu0:=4*Pi*10^(-7);a0:=0.04;b0:=0.02;d0:=0.1;

$$\mu_0 := \frac{\pi}{2500000} \quad a_0 := 0.04 \quad b_0 := 0.02 \quad d_0 := 0.1$$

> M0:=evalf(subs(mu=mu0,a=a0,b=b0,d=d0,M));

M0 := 0.9691351821 10⁻⁹

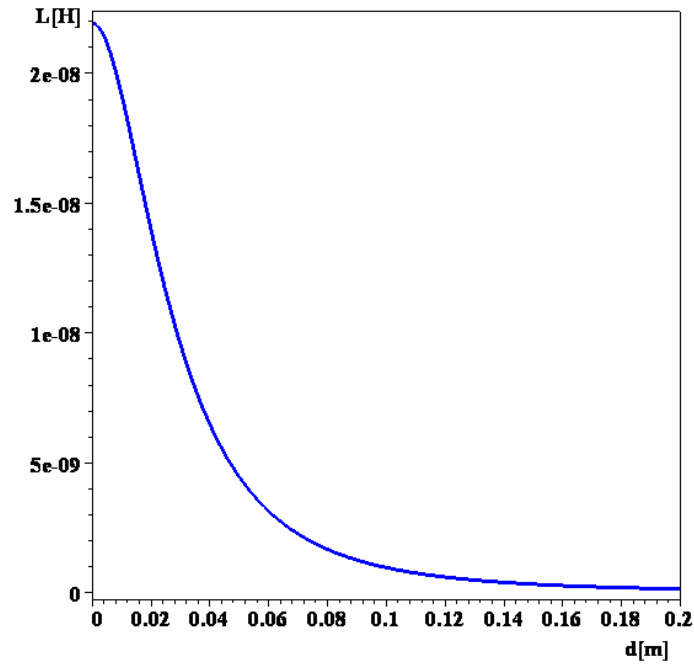


Fig. 7. Variation of mutual inductivity with distance d

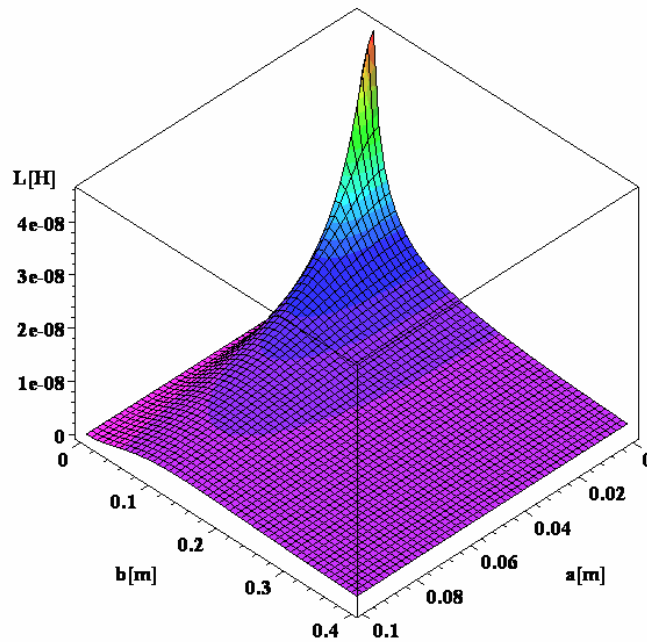


Fig. 8. Variation of mutual inductivity with a and b radii

4. CONCLUSIONS

The paper presents a new approach regarding to the self and mutual inductivities calculation. It is used the algebraic computation, which has the following advantages:

- the automatic writing of the general expressions (in any point from the space) of the magnetic field (or of the vector magnetic potential) by the adequate choice of the co-ordinates system (function of the problem symmetry) and the accurate calculation of these;
- the fast calculation of the self and mutual inductivities by the utilization of the relations of definition;
- the automatic drawing of the 2D and 3D plots, allowing that the suggestive images to be obtained;
- the development of the modeling skills, useful in the approach of others more complex problems;
- facilities in the treating of the limit cases (and of the degenerate cases, eventually);
- a better understanding of the physical phenomena corresponding to the analyzed field problem.

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A REAL OPERATING CONDITION TESTING SYSTEM FOR ELECTRIC TRACTION MOTORS AS PART OF AN INDEPENDENT WHEEL DRIVE

Stefan GHEORGHE¹

Mircea COVRIG²

Grigore DANCIU³

Costin CEPISCA³

Tudor URSU⁴

Sorin Dan GRIGORESCU⁵

Sanda Victorinne PATURCA⁶

Nicolae JULA⁷

Dorin OPREA⁸

¹ Department of Materials, Electrical Machines and Drives,

² Department of Automotive Engineering,

³ Department of Metrology, Instrumentation, Sensors and Transducers, University POLITEHNICA of Bucharest

⁴ Research Institute for Electrical Machines ICPE-ME SA

^{5,6,7,8} Military Technical Academy Bucharest

Abstract: - This paper presents a testing system designed and built by the authors for testing in real operating conditions the electric traction motors as part of an independent wheel drive electric vehicle. There are presented the solutions chosen for the mechanical part, the hardware and software related to the electric drive system and the monitoring system.

Key-Words: - electric vehicle, independent wheel drive, electric traction motors

1 Introduction

The independent wheel drive represents a promising alternative for the electric vehicle propulsion system, due to its quick and accurate response in the motion control and even the chassis control, allowing the vehicle to become more stable and robust, compared to differential based drive vehicles. Moreover, it offers the possibility of easy and efficiently implementing of advanced traction capabilities, such as ABS (Antilock Braking System) function, ASR (anti-Slip Regulation) function etc.

The electric motor design, as well as the optimization of the motor-inverter system performance, is related to the type of drive system: independent drive, with or without reductor, or differential based drive. The numeric simulation of the electrical drive and vehicle basic cinematic may offer good results regarding the evaluation of the whole system behavior and performance, but it becomes very complex when the real road conditions, along with the mechanical elements, are to be considered, especially in the case of an independent motor-wheel drive. For this reason, a research team from the Department of Electrical Machines and Drives, Faculty of Electrical Engineering, Polytechnic University of Bucharest, has designed and built a mobile platform for testing the electric motor prototypes in real road conditions. The project was financially supported by the CEEEX National Research Program. The functionality of this platform was afterwards extended to the testing the entire electrical drive – including motors, power modules and control – involved in an independent wheel drive system.

2 Technical requirements assigned to the testing system and the resulted solutions

The following requirements were established with the purpose of satisfying the testing conditions of the electric motors and motor-inverter system:

- safely movement in various road conditions;
- to make possible the easy attach / detach the motors;
- to have a direct (no reductor) and independent two-wheel drive system;
- each axle must have its own real-time motor control function implemented at the corresponding power modules level;
- real-time monitoring system for the characteristic quantities: voltage and current of the batteries, voltages and currents of each motor and power module, motors velocity

To accomplish these requirements, and for cost saving reasons, it was chosen a small classic vehicle – a Daewoo Matiz, from which the engine, gearbox, differential, the cooling and exhausting systems were detached. The remaining space obtained in the motor compartment, which can be seen in figure 1(a), was afterwards used for the electric motors. There were also detached the back seats, in order to create space for the battery pack, as shown in figure 1(b).



(a)



(b)

Fig. 1 The vehicle new arrangement: the motor compartment without the combustion engine and the related parts (a) and The back half of the vehicle, intended for the battery pack (one battery already mounted) (b)

The rest of the classic vehicle - chassis, brakes, steering, lighting - were used with no modifications.

3 The testing system description

Based on the requirements and considering the vehicle dimensions, there were established the testing system configuration and the corresponding electro-mechanical characteristics of each component, as described in the following subsections.

Regarding the constraints imposed by the vehicle dimensions, it imposes mainly the following constraints:

- The motors maximum dimensions are given by the distance between wheels, considering also the bear axles length;
- The maximum string batteries voltage is given by the dimensions and number of the batteries – limited by the available space in the back half of the car and the maximum supported mass.

The resulted limits of the related geometric and electric parameters are summarized in table1.

Table 1.

| Parameter | dimension |
|---|-----------|
| Maximum motor diameter, according to the ground clearance | 300 mm |
| Interior rotor diameter of the motor, so that the bear axle could be coupled to the motor | 41 mm |
| Maximum motor length | 135 mm |
| Maximum DC voltage provided by the string batteries | 120 V |

3.1 The mechanical structure supporting the motors

The solution chosen for creating the independent drive system was to build a structure immovable relative to the chassis, to which the electrical motors are fixed. It was a convenient solution regarding the amount of modifications that are to be done, considering the initial vehicle configuration. The motors are coupled to the wheels through the bear axles kept from the classic vehicle. In figure 2 it is presented the left side of the structure, supporting one of the two electric motors.

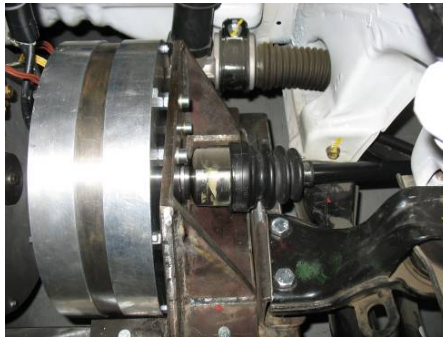


Fig. 2 The left side of the motor supporting structure

3.2 The electric drive

The scheme of the electric drive system is presented in figure 3. It includes the traction battery string delivering 120V voltage, the commutation and protection components – fuses F1 and F2, circuit breaker CB1, contactor C1 – and the power modules PM1 and PM2.

For the contactor command, working at 24 V, it was used an additional battery, B₂, the relay CR₁ and the original vehicle key switch.

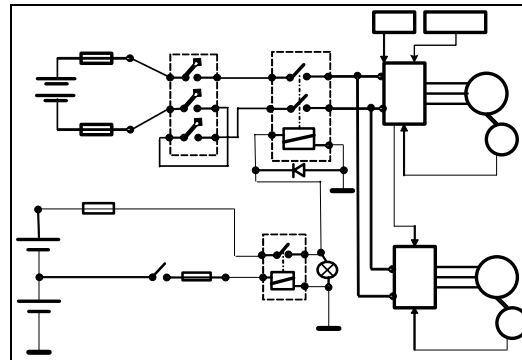


Fig. 3 The scheme of the electric drive system

The battery package contains ten Lead-acid Batteries – GB 12-100 type, BSB Power, 12 V and 100 Ah capacity, connected in series. The battery package is put in two rows, in place of the vehicle back seats, as shown in figure 4 (a), and the power modules are mounted on top of the battery pack, as shown in figure 4 (b).



Fig. 4 The battery package (a) and the power modules mounted on top of it (b)

The commutation and protection devices – the fuses, circuit breaker and contactor were placed so that to obtain a minimum wiring length [2]. The contactor was placed near the batteries and the circuit breaker was disposed between the front seats, to be accessible to the driver. The position of these elements is shown in figure 5a). The torque command is transmitted through a pedal position transducer which is linked to the acceleration cable – figure 5 b).

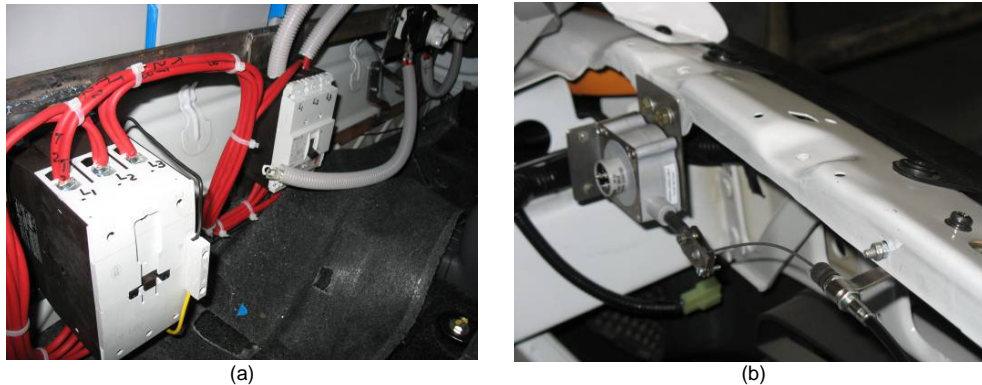


Fig. 6 The placement of the commutation and protection elements (a) and the pedal position transducer, connected to the vehicle acceleration cable (b)

Two brushless DC motors, previously designed by the research team and being subjected to test, complete the electric part of the independent wheel drive system – figure 7.



Fig. 7 The independent wheel drive, with two brushless DC motors

3.3 The control system

The basic structure of the command and control system is illustrated in figure 8. Both motor axes are independently driven, using one power modules for each motor PM1 and PM2, as shown in the same figure.

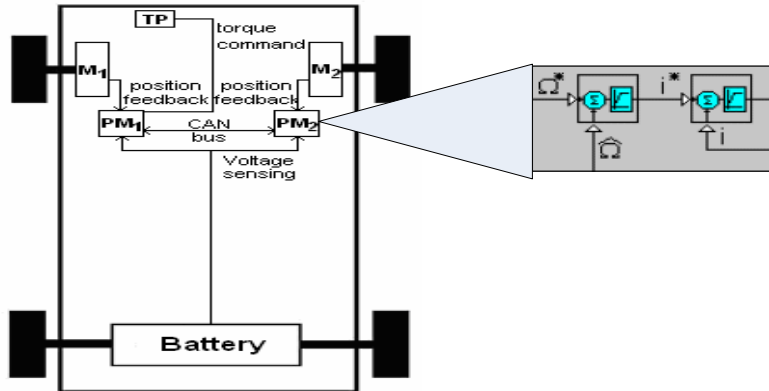


Fig. 7 The schematic of the independent wheel drive control system

Each power module, shown in figure 8, consists in two main parts:

- the power part – basically a three-phase bridge inverter, with pulse-width-modulation (PWM) driven IGBTs;
- the control part, which is implemented on a dedicated motion control board - Technosoft MSK2407, built around the fixed point Texas Instruments TMS320LF2407 Digital Signal Controller.

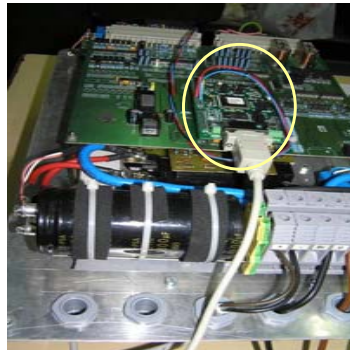


Fig. 8 The special - designed power module and its control

The board is software programmable using a high-level motion language and the IPM Motion Studio software package, both created by Technosoft. This package running on a PC, allows connection between PC and MCSK II, its setup configuration, the controller tuning etc. The program is downloaded from PC through RS-232 interface.

The primal software component of the control part is the real time motor control kernel, as part of the firmware already supplied with the board. There are several motor control techniques which can be easily chosen and configured using the graphical user interface: sensed (encoder) and sensor less vector control for sinusoidal permanent magnet motors (PMSM), or trapezoidal control for Brushless DC Motors using Hall sensors.

The software is especially designed for multiple axis control - the power modules are connected in a network using CAN (Controller Area Network) bus for communication. In the actual configuration of the vehicle drive system, one power module the master receives the torque command through an analog input, and transmits it to the slave power module by the CAN bus. The signal schematic is briefly shown in figure 7.

The distinctive feature of the entire drive system control is the modality chosen for the supervisor implementation. This is not a separate entity, but it is included in the master power module (PM1), at software level. The solution is economical and practical, as the controller board has sufficient processing and memory resources so that additional higher level tasks are supported: battery management, critical events counting and signaling.

3.3 The platform monitoring system

For the system monitoring it was made a dedicated software application, which is running on a laptop PC.

The specific motor and drives quantities can be acquired and viewed during the tests using a monitoring system, created for this purpose. The system main components are the transducers, the signal conditioning module, a PCMCIA data acquisition card – National Instruments DAQ-Card6062E – connected to a laptop and software application created in LabVIEW environment.

The analog signals from the voltage and current transducer are sampled with 20 kS/s. In actual configuration, the vehicle speed is calculated as the mean value of the individual motor velocities, which are determined using the pulses from the brushless DC motor Hall sensors.

The software application allows for on-line monitoring the measured quantities (motor and batteries currents, voltages and speed) and the calculated quantities (motor torque, power) in a continuous running time window of up to 60 seconds width.

In figure 9 is shown an extras from the monitoring application front panel, where there can be seen the variation of the vehicle speed and the total current and power delivered by the batteries.

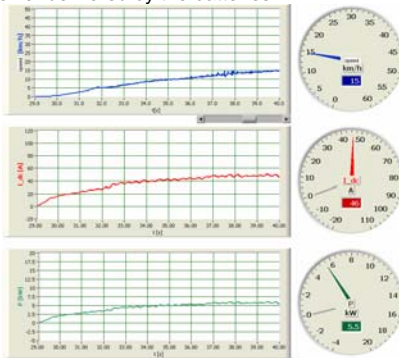


Fig. 9 Sample view of the monitoring application front panel showing the variation of the vehicle speed (up), and of the current (middle) and power (down) delivered by the batteries during vehicle start

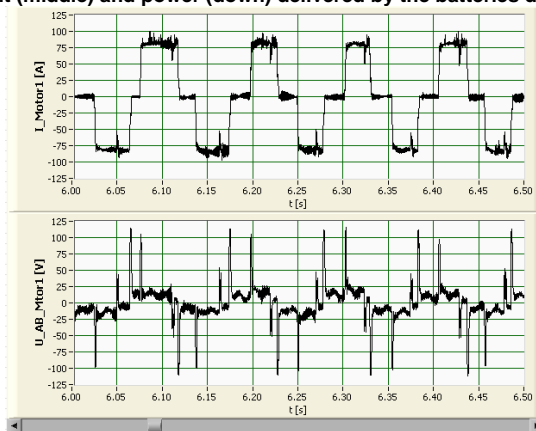


Fig. 10 The variation of the motor's phase current and line voltage

The acquired quantities can also be displayed in detail, as shown in figure 10 – where it is represented the variation of the phase current and line voltage of one motor. The time axis of two or more graphs can be synchronously scrolled, when offline, in order to analyze and correlate quantities variations during the test.

5 Conclusion

This paper summarized the solutions adopted by the authors concerning the design and development of a testing system intended for independent wheel drives. The use of a specific motion control boards along with their software package permit easy set-up and tuning of several motor control techniques, so that the entire electric drive system can be tested in different regimes encountered in real operating conditions. A dedicated monitoring system was built to acquire various motor and drives quantities during tests, which can be used for refining the motors parameters and the independent drive system control strategies.

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EXPERIMENTAL STUDY ON THE OXYGEN FLOW IN OXYGEN ASSISTED LASER CUTTING

Valentin GLOD¹
Remus BOBOESCU²

¹ Mr. drd. Eng. Glod Valentin Military school “Eremia Grigorescu” Sibiu , Romania

² Drd. Boboescu Remus Politehnica University Timișoara

Abstract *Oxygen assisted laser cutting is a widespread industrial process, especially in shipbuilding industry. There is an experimental research on the cut of 3mm thick steel using a CO₂ laser with maximum power of 1.5 kW under pulsed regime .Cutting process is controlled by changes in oxygen pressure, laser power, cutting speed , pulses frequency and the operating cycle of the laser. In addition ,the effect of distance between oxygen blowing nozzle and piece is studying. Cutting process is characterized by the cut width. It has developed a direct analytical method for determining the effect of changes in cut width due variation of nozzle-piece distance .*

Keywords: *laser oxygen cutting, cut width, relative variation*

1. Introduction

Oxygen assisted laser cutting is a process of material removal applied to steels. It uses laser and chemical reaction of iron burning in oxygen to melt and remove the material. The laser is warm heat source needed to start the iron burning. Combustion of iron in oxygen provides the energy needed to melt nearby iron. The oxygen jet gas ensures removal of melted material and in the same time supplying for combustion reaction. Laser cutting of steel allows achieving quality cuts for thin steel plates. Laser cutting is widespread in shipbuilding. It offers fast cutting of large quantities of steel plates.

Oxygen assisted laser cutting involves setting three independent sets of parameters: parameters of laser beam parameters of oxygen jet, parameters of robotic system that provides relative movement between the laser head and piece. All these parameters takes contributions to achieve the cut. In this context experimental research in the laser oxygen assisted cutting process is a open field of study. The research process is accompanied by research on the material surface and heat affected structure. Laser cutting process under experimental conditions close to those used in our experiments was presented in [1], [2], [3].

This work proposes the study of a situation commonly found in experimental research where some parameters may vary easy on the machine control and other parameter requires to use of another commands which are usually maintained constant.

In this case were set on the machine control program working oxygen pressure, cutting speed and laser irradiation condition (by average power, pulse frequency, and operation cycle).These five factors of influence are the main parameters controlling the laser cutting. The goal of study was to add at previous mentioned parameters the distance nozzle-piece (ddp) and show the significance of changes by physical and technological point of view. The nozzle is the exit part of laser head, near the workpiece. The laser head contains gas and focusing systems. The distance nozzle-piece has a influence on gas flow and focusing point related to piece surface.

In the experiments was made series with three values for each main parameter. This was repeated for two values of distance between the nozzle and piece (ddp 1mm) and (ddp 2mm). The cut width was was measured. This highlight the main quantitative and qualitative aspects of the cutting process.

The relative variations of cut width between the two cases (ddp 1mm) and (ddp 2mm) was calculated. These were analyze in relations with variation of main parameters. Processing data were interpretat from phenomenological point of view.

2. Experimental procedure

In the experiments was used a laser with CO₂ with maxim power 2kW of type MAZAK, the operation were in pulsatd regime PW. The sheet cold rolled OL 37 STAS 5002, S185, S235, S355 SR EN 10025 with the thickness of 3 mm product of S. C. SIDEX Galati was used.. The sizes of the steel sheet were de150 X 500 X 3 mm. The chemical composition across the producer is Fe = 99, 63, C = 0, 37.The cuttings had the length of 100 mm and didn't separated complete (with the aim to measure the sizes of the kerfs). Between the two cuts were left an aisle of 40 mm. The experimental plan had as the aim the study of sliding parameters about the cutting process. There through follow on aside put in evidence a condition limit in which the process is realizable and the other side the study of cutting effectuation. Also we took into consideration that the method of his experimentation is useful for the models realization and can achieved the interpretations about the physical which phenomena are in progress in times of the process. The change factors as part as the experiments were:

-**Oxygen pressure P_{O₂}[bar]**. Oxygen pressure was measured to exit from reservoir. It has an influence about the speed of the gas in kerf and about chemical reaction of burn the iron. This is a process parameter.

-**Average power P [W]**. This is set on the numerical command .

- **Cutting speed v [mm/min]**. This is represents the speed of laser head advance about piece. It influence significant about the process generally and about the irradiation in particular. This is set on the numerical command.

-**Frequency of the pulses f[Hz]**. This represents the number of pulses on the times unit.
This is set on the numerical command.

- **Cycle η [%]**. This represents the fraction among the time of the pulse and the time the total between two pulses (1/f).
This is set on the numerical command.

For each of the parameters listed above were considered an experimental series with three values. Incomplete cuts were made. The cut width was measured using a microscope with accuracy of 0.01 mm. For each cut was measured width at the top of the piece, the width at the bottom of the piece and was calculated their average. Cut width is a value which can be directly associated with quality of cut and cutting process stability.

In the experiments was varied the distance between the nozzle and piece (ddp), by the vertical movement of the laser head. There was two values ddp1 mm and ddp 2 mm. Exact position of the focal spot to the piece surface was not determined in both cases.

3. Analysis of cut width relative changes

For the two positions between the nozzle and piece (ddp 1mm and ddp 2 mm) were made cuts in the same experimental conditions. Was measured the width of cut (width at the top, index s, width at the bottom, index i, and average width, between the top and bottom of cut, index m). Average of two measurements for ddp 1mm and ddp 2 mm was recorded as the reference value (L_s, L_i, L_m). Was calculated widths difference L (ddp1mm)-L (ddp2mm). This was recorded as the difference ($\Delta L_s, \Delta L_i, \Delta L_m$). Based on these data was calculated relative change for cut width ($\Delta L_s/L_s, \Delta L_i/L_i, \Delta L_m/L_m$). These relative variations of cut width were subject of analysis. Positive sign shows that the cut width is greater for ddp1mm. Negative sign indicates that the cut width of is greater for ddp 2mm.

Table 1 Relative values for the cut width between ddp 1mm and ddp 2mm for variation of oxygen pressure for P=1500 [W] v=2500 [mm/min] $\eta=85\%$ f=500[Hz]

| variable | Reference value [mm] | | | Difference [mm] L(ddp1mm)-L(ddp2mm) | | | Relative variation [%] | | |
|-----------------|----------------------|-------|-------|--|--------------|--------------|--------------------------|--------------------------|--------------------------|
| | L_s | L_i | L_m | ΔL_s | ΔL_i | ΔL_m | $\frac{\Delta L_s}{L_s}$ | $\frac{\Delta L_i}{L_i}$ | $\frac{\Delta L_m}{L_m}$ |
| P_{O_2} [bar] | | | | | | | | | |
| 0.6 | 0.445 | 0.354 | 0.399 | -0.11 | -0.137 | -0.123 | -24.7 | -38.6 | -30.8 |
| 1,2 | 0.446 | 0.304 | 0.375 | -0.007 | -0.037 | -0.022 | -1.5 | -12.1 | -5.8 |
| 2 | 0.48 | 0.296 | 0.388 | -0.1 | -0.153 | -0.126 | -20.8 | -51.6 | -32.5 |

Table 1 shows the relative variation of the cut width with oxygen pressure. It noted that use of ddp 2mm has increased the cut widths. They were higher for low and high pressure. Bottom cut width has more strong variation than top cut width.

The negative for cut width (for all three pressures and top, bottom and average width) show for ddp 2mm an increase of laser intensity (W/cm^2) on the piece surface due bring focal spot from inside piece to surface piece. On the other hand oxygen pressure produces situations where exothermic combustion reaction of iron is favored. The pressure effect is separate from irradiation effects that of radiation, so the data from Table 1 shows that the between cases ddp 1mm and ddp 2 mm have changed the conditions of irradiation.

Table 2 Relative values for the cut width between ddp 1mm and ddp 2mm for variation of laser power for v=2500 [mm/min] $\eta=85\%$ f=500[Hz] $P_{O_2}=0.8$ [bar]

| variable | Reference value [mm] | | | Difference [mm] L(ddp1mm)-L(ddp2mm) | | | Relative variation [%] | | |
|----------|----------------------|-------|-------|--|--------------|--------------|--------------------------|--------------------------|--------------------------|
| | L_s | L_i | L_m | ΔL_s | ΔL_i | ΔL_m | $\frac{\Delta L_s}{L_s}$ | $\frac{\Delta L_i}{L_i}$ | $\frac{\Delta L_m}{L_m}$ |
| P [W] | | | | | | | | | |
| 300 | 0.338 | 0 | 0.169 | -0.056 | 0 | -0.028 | -16.5 | - | -16.5 |
| 800 | 0.404 | 0.348 | 0.376 | -0.023 | -0.036 | -0.029 | -5.6 | -10.3 | -7.8 |
| 1200 | 0.479 | 0.398 | 0.438 | -0.007 | -0.036 | -0.021 | -1.4 | -9. | -4.9 |

Table 2 presents the relative variation of the cut width with laser power. It shows small changes of cut width. At the same laser power is observed that the position of nozzle-piece ddp 2 mm make small increase of cut width in all analyzed cases. It is noted that greater changes occur to the width at the bottom of the cut and if the use of low power. In this case variation of intensity due to movement of the focal plane to piece surface gets bigger in relation to power effect.

Table 3 Relative values for the cut width between ddp 1mm and ddp 2mm for variation of cutting speed for P=1500 [W] $\eta=85\%$ f=500[Hz] $P_{O_2}=0.8$ [bar]

| variable | Reference value [mm] | | | Difference [mm] L(ddp1mm)-L(ddp2mm) | | | Relative variation [%] | | |
|------------|----------------------|-------|-------|--|--------------|--------------|--------------------------|--------------------------|--------------------------|
| | L_s | L_i | L_m | ΔL_s | ΔL_i | ΔL_m | $\frac{\Delta L_s}{L_s}$ | $\frac{\Delta L_i}{L_i}$ | $\frac{\Delta L_m}{L_m}$ |
| v [mm/min] | | | | | | | | | |
| 300 | 1.275 | 1.476 | 1.375 | 0.59 | 0.587 | 0.588 | 46.2 | 39.7 | 42.7 |
| 1300 | 0.545 | 0.413 | 0.479 | -0.17 | -0.18 | -0.175 | -31.1 | -43.5 | -36.5 |
| 4000 | 0.494 | 0.426 | 0.460 | -0.037 | -0.053 | -0.045 | -7.4 | -12.4 | -9.7 |

Table 3 presents the relative variation of the cut width of cut with cutting speed. At low cutting speed (300 mm / min) the cut width has a strong decrease at ddp 2mm. Changes in the cut width at the top are greater than the changes in the cut width at bottom. These are explained by an increase in vaporization of metal due of increasing laser intensity at the surface of the piece. This is an adverse effect on the exothermic chemical reaction. Analyzed for other cutting speeds increase width cuts when ddp 2mm. Change the width between the two cases (ddp 1mm and ddp 2mm) is lower as increasing cutting speed. The major variations are recorded for cut width at the bottom.

Table 4 Relative values for the cut width between ddp 1mm and ddp 2mm for variation of pulses frequency for P=1500 [W] v=2500 [mm/min] η=85[%] P_{O2}=0.8 [bar]

| vari- able f[Hz] | Reference value [mm] | | | Difference [mm] L(ddp1mm)-L(ddp2mm) | | | Relative variation [%] | | |
|------------------------|----------------------|----------------|----------------|--|-----------------|-----------------|---------------------------|--------------------------|--------------------------|
| | L _s | L _i | L _m | ΔL _s | ΔL _i | ΔL _m | $\frac{\Delta L_s}{L_s}$ | $\frac{\Delta L_i}{L_i}$ | $\frac{\Delta L_m}{L_m}$ |
| 80 | 0.523 | 0.504 | 0.513 | 0.02 | 0.043 | 0.031 | 3.8 | 8.5 | 6.1 |
| 250 | 0.513 | 0.47 | 0.491 | 0.034 | -0.12 | -0.043 | 6.6 | -25.5 | -8.7 |
| 600 | 0.461 | 0.368 | 0.414 | 0.07 | -0.024 | 0.023 | 15.1 | -6.5 | 5.5 |

Table 4 presents the variation of cut width with cut if the pulse frequency. It is noted that these data present two cases, the greater cut width for ddp 1 mm at the reverse the greater cut width for ddp 2 mm. The first case is shown for the top cut width and the second for the bottom cut width.

Like the cutting speed the frequency rate acts directly on the interaction time by increasing its. Under these conditions increased frequency and intensity on the surface produces an increase in vaporization.

Table 5 Relative values for the cut width between ddp 1mm and ddp 2mm for variation of cycle for P=1500 [W] v=2500 [mm/min] f=500[Hz] P_{O2}=0.8 [bar]

| vari- able η [%] | Reference value [mm] | | | Difference [mm] L(ddp1mm)-L(ddp2mm) | | | Relative variation [%] | | |
|------------------------|----------------------|----------------|----------------|--|-----------------|-----------------|---------------------------|--------------------------|--------------------------|
| | L _s | L _i | L _m | ΔL _s | ΔL _i | ΔL _m | $\frac{\Delta L_s}{L_s}$ | $\frac{\Delta L_i}{L_i}$ | $\frac{\Delta L_m}{L_m}$ |
| 50 | 0.378 | 1.035 | 0.706 | -0.01 | 0.39 | 0.19 | -2.6 | 37.6 | 26.8 |
| 70 | 0.413 | 0.548 | 0.480 | 0.054 | 0.316 | 0.185 | 13 | 57.6 | 38.5 |
| 95 | 0.445 | 0.346 | 0.395 | -0.01 | -0.06 | -0.035 | -2.2 | -17.3 | -8.8 |

Table 5 shows relative values of cut width with cycle. It produces different variations (in sign and amount) for low values of cycle. Also it shows different effect on the top cut width, compared effect at the bottom cut width. The cycle has a influence on pulse time. Low values of the cycle produce instabilities in chemical reaction and vaporization of material irradiated.

Conclusions

Measuring the cut width of the cut in two cases for ddp1mm and ddp 2 mm, and analysis of the relative variations of it for other experimental parameters variations showed the following:

- For distance nozzle-piece ddp1mm laser beam was focused inside the piece. Increasing distance nozzle-piece ddp 2 mm laser spot focus (focal plane) goes to the piece surface.

It is produced in increased laser intensity on the surface in case ddp 2 mm.

- Increasing the interaction time between laser and material decreases cut width at ddp 2mm. This decrease is associated with the vaporization effect due to the increased intensity laser surface. Vaporization disadvantage exothermic chemical reaction and reduces the cut width.

- Increasing the interaction time by decreasing the cutting speed and increased frequency for ddp 2 mm decrease cut width. Decreased cycle result a decrease of pulse, but appointed for trial, the effect is equivalent to a decrease in frequency. Decreased cycle associated with the change of distance between the nozzle-piece cause instability to the cut width.

-For small times of interaction between laser and piece a change in position nozzle-piece will play a stronger effect on the width at the bottom of cut compared with the width at the top of cut. For greater interaction times between laser and piece a change in position nozzle-piece variation will be stronger for the top cut width.

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SUSCEPTIBILITY OF PARAMETRIC ROLL RESONANCE INDUCED BY ROAD WAVINESS IN LAND VEHICLES

Kunsel-Özel IZET- ÜNSALAN¹
Deniz ÜNSALAN²

¹ Associate Professor, Ph. D. Eng., Ovidius University, Constanta, ROMANIA

² Commander, Turkish Navy (R), Professor, Ph. D. Eng., Piri Reis University, Tuzla, Istanbul, TURKEY

Abstract: Parametric roll resonance is a well-known phenomenon in certain marine vehicles when the change in roll stability parameters experienced as the ship progresses in waves with a frequency of encounter becomes equal to twice natural frequency of roll of the ship. In its canonical form, it can be explained by the Mathieu differential equation. It has been a recent area of study of naval architects, where various aspects of the phenomenon have been studied. The aim of this paper is to show that the same phenomenon is also a possibility, at least in theory, where the regular road waviness can induce parametric roll in land vehicles.

Key words: Parametric resonance, vehicle roll, road waviness, Mathieu differential equation

1. Introduction

Parametric roll resonance is a phenomenon well-known in marine field, where the waves encountered by a ship, even in fore-aft direction, have a period of encounter equal to half the natural period of roll of the ship. This can be attributed to the periodic vertical changes in the position of metacenter due to the change of waterline shape of the hull, which is the basic parameter for ship transverse stability [1]. The authors have studied the same phenomenon for land vehicles on wavy roads, where vertical accelerations are induced on the vehicle. The same phenomenon is shown to occur on land vehicles, albeit the shock absorbing mechanisms induce a damping on the transverse roll motion of the vehicle.

2. Analysis of vertical accelerations on a land vehicle

The suspension system of a land vehicle with a small length can be modelled as shown in figure 1 (This model is named in the literature as “quarter vehicle suspension model”)[2].

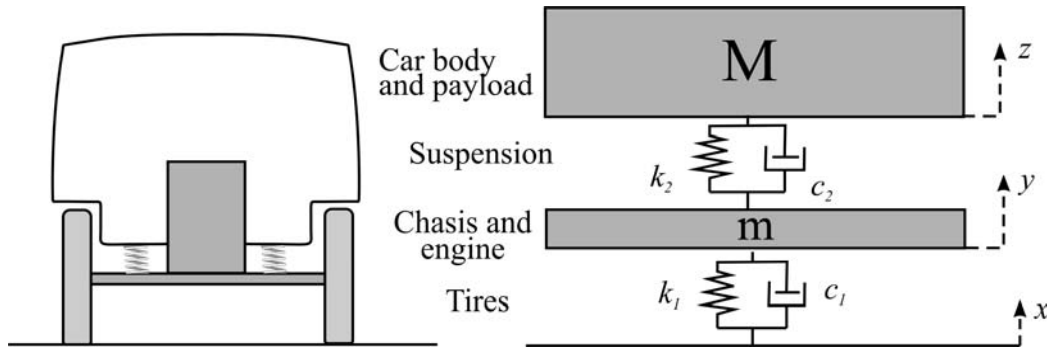


Figure 1. Modelling of the suspension system (tires, suspension springs, shock absorbers) of a land vehicle

Hence, the vertical motions of the vehicle can be expressed in matrix form as:

$$\begin{bmatrix} m & 0 \\ 0 & M \end{bmatrix} \cdot \begin{bmatrix} \ddot{y} \\ \ddot{z} \end{bmatrix} + \begin{bmatrix} c_1 + c_2 & -c_2 \\ -c_2 & c_2 \end{bmatrix} \cdot \begin{bmatrix} \dot{y} \\ \dot{z} \end{bmatrix} + \begin{bmatrix} k_1 + k_2 & -k_2 \\ -k_2 & k_2 \end{bmatrix} \cdot \begin{bmatrix} y \\ z \end{bmatrix} = \begin{bmatrix} c_1 \dot{x} + k_1 x \\ 0 \end{bmatrix} \quad (1)$$

where m refers to the combined mass of car body and payload, M refers to the combined mass of chassis and the engine, c_1 and k_1 refer to the lumped damping and spring constants of the tires, c_2 and k_2 are the lumped damping constant of the shock absorbers and the the spring constant of the suspension springs respectively. Hence, the eigen values $\lambda = \omega_n^2$ of the vertical motions of the car are the roots of the characteristic equation:

$$\lambda^2 - \left(\frac{k_2}{M} + \frac{k_1 + k_2}{m} \right) \lambda + \frac{k_1 k_2}{mM} = 0 \quad (2)$$

The solution for the motion of the car body and payload by a harmonic excitation transmitted by tires can be calculated by neglecting damping as:

$$\begin{bmatrix} \ddot{y} \\ \ddot{z} \end{bmatrix} = - \begin{bmatrix} \frac{1}{M} & 0 \\ 0 & \frac{1}{m} \end{bmatrix} \cdot \begin{bmatrix} k_1 + k_2 & -k_2 \\ -k_2 & k_2 \end{bmatrix} \cdot \begin{bmatrix} y \\ z \end{bmatrix} + \begin{bmatrix} \frac{1}{M} & 0 \\ 0 & \frac{1}{m} \end{bmatrix} \cdot \begin{bmatrix} k_1 x \\ 0 \end{bmatrix} \quad (3)$$

For a harmonic excitation transmitted from the road, as expressed by $x = X_m e^{j\omega_e t}$ the motion of the car body and payload can be found as:

$$\begin{bmatrix} \frac{k_1 + k_2}{m} - \omega_e^2 & -\frac{k_2}{m} \\ -\frac{k_2}{M} & \frac{k_2}{M} - \omega_e^2 \end{bmatrix} \cdot \begin{bmatrix} Y_m \\ Z_m \end{bmatrix} = \begin{bmatrix} \frac{k_1}{m} X_m \\ 0 \end{bmatrix} \quad (4)$$

where $y = Y_m e^{j\omega_e t}$ and $z = Z_m e^{j\omega_e t}$ are assumed. Solving equation (4),

$$Y_m = \frac{\frac{k_1}{m} \left(\frac{k_2}{M} - \omega_e^2 \right) X_m}{\left(\frac{k_1 + k_2}{m} - \omega_e^2 \right) \cdot \left(\frac{k_2}{M} - \omega_e^2 \right) - \frac{k_2^2}{m \cdot M}} \quad (5)$$

and:

$$Z_m = \frac{\frac{k_2}{M}}{\frac{k_2}{M} - \omega_e^2} \cdot Y_m \quad (6)$$

are found for the amplitudes of vertical motions of chassis and car body respectively. It can be seen by inspection that for low values of road excitation frequency, ω_e relative to the square roots of the two eigenvalues to be determined from equation (2), $y \cong x$ and $z \cong x$. In other words, the car body follows the contours of the road.

A car, advancing on a road with a periodic waviness of wavelength λ and waveheight X_m with a speed of V will experience vertical accelerations excited by excitation on tires by:

$$x = X_m \cos \frac{2\pi}{\Lambda} Vt \quad (7)$$

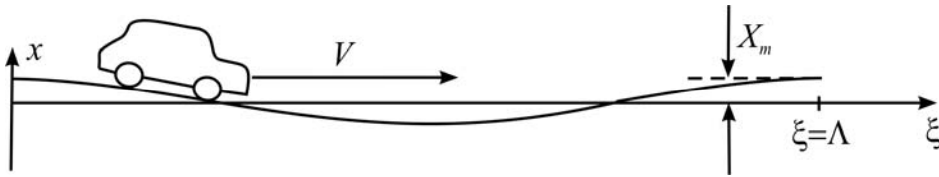


Figure 2. A land vehicle on a road with a regular waviness

Naming the parameter $2\pi V/\Lambda$ as ω_e , it becomes apparent that the road exerts a sinusoidal excitation on the car in the vertical direction via the tires with an amplitude of X_m and frequency ω_e .

For road excitations with frequencies below the natural frequencies of the suspension system, as expressed previously by equations (1)-(6),

$$z \cong X_m \cos \omega_e t \quad ; \quad \ddot{z} = -\omega_e^2 X_m \cos \omega_e t \quad (8)$$

3. Parametric Roll Analysis

The transverse motion of a land vehicle can be expressed by the differential equation:

$$\ddot{\varphi} + C(\dot{\varphi}) + \frac{M(\varphi)}{I} = 0 \quad (9)$$

where φ is the roll angle, $C(\varphi)$ is the roll damping function, I is the moment of inertia of the car body and the payload combined and $M(\varphi)$ is the roll restoring moment, provided by the suspension springs.

Roll restoring moment can be approximated by the instantaneous value of the rolling moment, taking the vertical accelerations into account:

$$M(\varphi) = \overline{KG} m (g + \ddot{z}) \sin \varphi \quad (10)$$

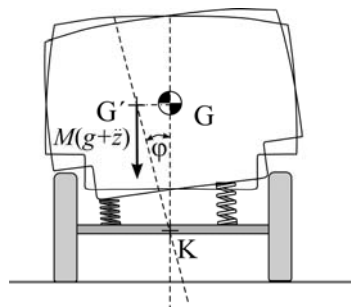


Figure 3. Roll motion of a land vehicle with a horizontal chassis

Representing the moment of inertia of the car by $I = m\rho^2$, where ρ is the radius of gyration:

$$\ddot{\varphi} + C(\dot{\varphi}) + \overline{KG} \cdot \frac{(g + \ddot{z})}{\rho^2} \sin \varphi = 0 \quad (11)$$

Substituting for \ddot{z} in this last equation, the following equation is obtained for negligible damping and small angles of roll:

$$\ddot{\varphi} + \omega_n^2 \left[1 - \omega_e^2 \frac{X_m}{g} \cos \omega_e t \right] \varphi = 0 \quad (12)$$

where the natural frequency of roll is given by:

$$\omega_n = \frac{\sqrt{g \cdot KG}}{\rho} \quad (13)$$

Using the transformation $\tau=1/2 \omega_e$, equation (12) can be transformed into the form:

$$\frac{d^2\varphi}{d\tau^2} + \left[4 \left(\frac{\omega_n}{\omega_e} \right)^2 + 4 \frac{X_m}{g} \cos 2\tau \right] \varphi = 0 \quad (14)$$

This last equation is known as the “Mathieu equation”, which appears in literature in the canonical form:

$$\frac{d^2\varphi}{d\tau^2} + (a - 2b \cos 2\tau) \varphi = 0 \quad (15)$$

where

$$a = 4 \left(\frac{\omega_n}{\omega_e} \right)^2 \quad (16)$$

and

$$b = 4 \frac{X_m}{g} \quad (17)$$

Mathieu equation has regions of stable and instable solutions. In the latter case, the solution becomes unbounded. Those regions are shown in the Strut-Ince diagram (Figure 4) [3].

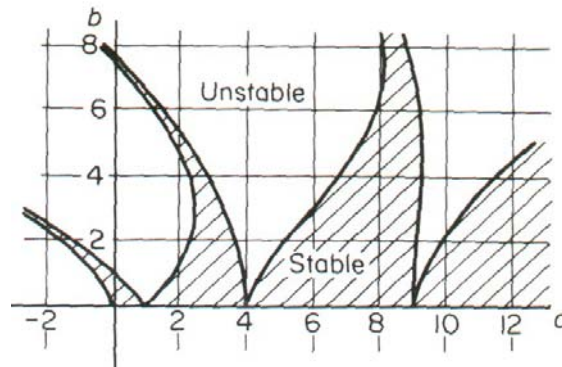


Figure 4. Strut-Ince diagram, showing regions of stable(shaded) and unstable(unshaded) solutions, reproduced from Thomson [3].

The regions intercept the horizontal axis at points where $a = n^2$, $n = 1, 2, \dots$. However, as has been experienced in various cases, the most well known case corresponds to $n=1$, or $\omega_e=2\omega_n$. Known as “parametric resonance” in engineering, it is a case met in certain ships in head/stern waves, in noncircular shafts, etc. As can be seen from equation (14), this can also be the case in wavy roads, where this last condition ($a = 1$) can be expressed as:

$$\frac{V}{\Lambda} = \frac{1}{\pi} \sqrt{g \cdot KG} \quad (18)$$

4. An illustrative example

As an illustrative example, a passenger hatchback car, laden with its driver and a passenger, having a center of gravity height (above chasis) of $KG=0.50$ m and radius of gyration of $\rho = 0.60$ m on a road with a waviness of $X_m=0.15$ m and a wavelength $\Lambda = 25$ m is considered. From the last equation derived, it can be seen that susceptibility to parametric resonance occurs when $V= 29.37$ m/s or 105.7 km/hr.

At the same time, the value of parameter b shall be 0.0618, which is a small number in reference to figure 4. The existence of damping below a finite value, even for $a = 1$ shall easily mitigate parametric resonance, so the parametric excitation exerted by the road waviness will possibly not cause parametric roll unless the accelerations induced do not exceed a threshold value[4].

5. Conclusions

It has been shown that the parametric resonance phenomenon is a factor that can result in roll motion in land vehicles, at least in theoretical cases. Although this effect is mitigated by the damping in the shock absorption mechanism and by the internal damping of the springs, high values of periodic vertical accelerations can easily cause parametric resonance, which is a factor that the designers should be aware of.

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HIGH RESOLUTION POSITION INDUCTIVE TRANSDUCERS FOR MILITARY APPLICATIONS

Nicolae JULA¹
Tudor URSU²
Costin CEPISCA³
Ciprian RACUCIU⁴

¹ PhD Professor at Military Technical Academy

² PhD in Electrical Engineering and first degree Senior Researcher at Sistem Euroteh

³ PhD Professor at Politehnica University from Bucharest

⁴ Colonel, PhD Professor at Military Technical Academy

Abstract: *In this paper the authors present certain theoretical, conceptual and technological aspects on main types of high resolution inductive transducers for military applications. Inductive resolvers, as well as inductive RVDT, have a priority in these applications, even other types of position transducers, as optical, capacitive or magnetic encoders are in competition.*

In the world there are many researchers that continue activity of conceptual and technological development to increase the resolution level of the inductive resolvers and inductive RVDT, as well as to obtain smaller and smaller dimensions, just it is requested in such kind of applications. On the other hand, the inductive transducers are more adapted at harsh mechanical and climatic conditions that are usual for military applications. The paper is referring, especially, to inductive transformers type resolver.

Key words: *inductive transducers, high resolution, harsh conditions*

1. General aspects

Position inductive transducers are used as main components in the military applications where it is required a very high accuracy. For example, a modern measurement and control system including a synchro-resolver transmitter type and a synchro-resolver receiver type represents a most frequent solution to acquire the position information in a very accurate manner for a large range of applications.

In fact, a position inductive transducer is used to translate into electric magnitude an angular or linear dimension and consists of an asynchronous electric machine, especially developed to produce a system of alternative outputs having variable amplitude.

It may be considered that this electric machine is a kind of retort at the general electric transformer, having any elements fix, so having only a certain magnitude of output.

However, the purpose was not to be a retort, but to solve some important needs that the progress of systems and applications had required at a moment. We have to remark that, as an important difference given the situation of a classic asynchronous electric machine, a position inductive transformer generates output signals as a transformation component, this one depending of rotation speed insignificant. Generally, the component depending of rotation speed is taken into consideration in a global error factory. The authors had conceived, developed, built and tested many types of position inductive transducers, paying a special attention to analyse back e.m.f. accuracy relative to different types of winding schema, as well as to do a right interpretation regarding the results obtained on vectorial measurements methods. Also, were made many tests in special environment conditions, similar to the conditions for military applications. These tests had demonstrated that the level of accuracy and a global physical resistance are kept in these special harsh conditions.

In the authors opinion, in the position inductive transducers class may be considered: rotary inductive transformers, to measure the angular position, components that are generally named rotary inductive potentiometers, including: resolvers, microsins and RVDT; linear inductive transformers, to measure the linear position, components that are generally named linear inductive potentiometers, including specially the transducer LVDT type.

We have to remark that, especially in the last time, the users had replaced in certain applications the inductive transducers with encoders (based on optical, capacitive or magnetic phenomenon) and it was expressed by some producers a concept according with that the inductive transducers shall be replaced totally and forever with the encoders. But, the reality had demonstrated that this concept is completely wrong because it is not based on the whole spectrum of criteria. Some users and producers had considered only the price, but when a high accuracy is requested the price of inductive transducers seem to be lower. Moreover, some characteristics as: robustness, high resistance at harsh environment conditions, a perfect capacity to operate in an atmosphere with smog, fog, vapour or suspension assure to use the resolvers a very long time in the future.

Through the evolution of machine development, builders and system integrators alike, agree that the inductive transducer is unsurpassed in its ability to reliably supply rotary position data in the harshest environment conditions. So, any segregation is not useful: the inductive transducers, as well as the encoders, are used and will be used by different users just according with their needs, interests and affinity.

2. Position inductive transducers type Resolver

2.1. Construction. Representative equations. Representative diagrams.

A resolver is a position sensor or transducer which measures the instantaneous angular position of the rotating shaft to which it is attached. Resolvers and their close cousins, synchros, have been in use since before World War II in military applications such as measuring and controlling the angle of gun turrets on tanks and warships. Resolvers are typically built like small motors with a rotor (attached to the shaft whose position is to be measured), and a stator (stationary part) which produces the output signals.

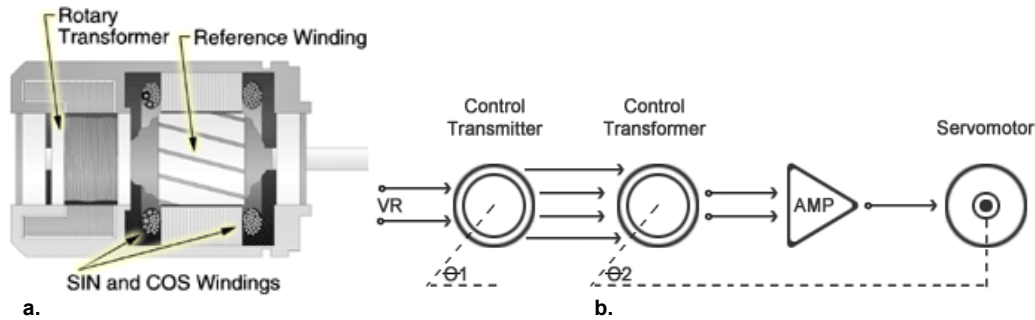


Fig. 1

- a. Showing resolver construction with housing, bearings and transformer**
- b. Typical control of electromechanical servo-system**

The word resolver is a generic term for such devices derived from the fact that at their most basic level they operate by resolving the mechanical angle of their rotor into its orthogonal or Cartesian (X and Y) components. From a geometric perspective, the relationship between the rotor angle (θ) and its X and Y components is that of a right triangle.

Fundamentally, then, all resolvers produce signals proportional to the sine and cosine of their rotor angle. Since every angle has a unique combination of sine and cosine values, a resolver provides absolute position information within one electric revolution (360°) of its rotor. This absolute (as opposed to incremental) position capability is one of the resolver's main advantages over incremental encoders. However, we have to remark that the absolute character is related only one electric revolution, so to have an absolute reference for whole physical rotation (mechanical 360°) it must to build the resolver only with two poles. Like all transformers, the resolver requires an AC carrier or reference signal (sometimes also called the excitation) to be applied to its primary. The amplitude of this reference signal is then modulated by the sine and cosine of the rotor angle to produce the output signals on the two secondaries. In any transformer, there is a value which relates the output voltage produced by the secondary to that fed into the primary. For resolvers, this quantity is called the transformation ratio or **TR** and is specified at the point of maximum coupling between primary and secondary. If we define the reference voltage $V(R1-R2)$ as **VR**, then the voltages on the secondaries are given by the following equations:

Primary Input: $V(R1-R2) = VR = E_{1max} \sin \omega t$
 Sine Secondary: $V(S2-S4) = VS = VR TR \sin(\theta)$
 Cosine Secondary: $V(S1-S3) = VC = VR TR \cos(\theta)$

where θ is the mechanical angle of the rotor as shown previously in the resolver schematic (fig. 2 and fig. 3).

If we excite the resolver primary (**VR**) with the recommended sinusoidal reference signal, the secondary voltages are also sinusoidal at the same frequency and nominally in phase with the reference. Their amplitude is proportional to the amplitude of the reference, the transformation ratio of the resolver, and the sine or cosine of the mechanical angle of the rotor. Using a typical value of **TR** as **0.5**, we can look at the secondary voltages for different rotor angles as they would appear on an oscilloscope (fig. 4).

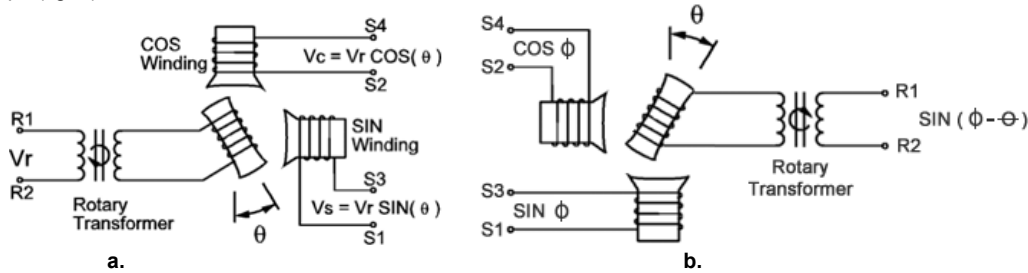
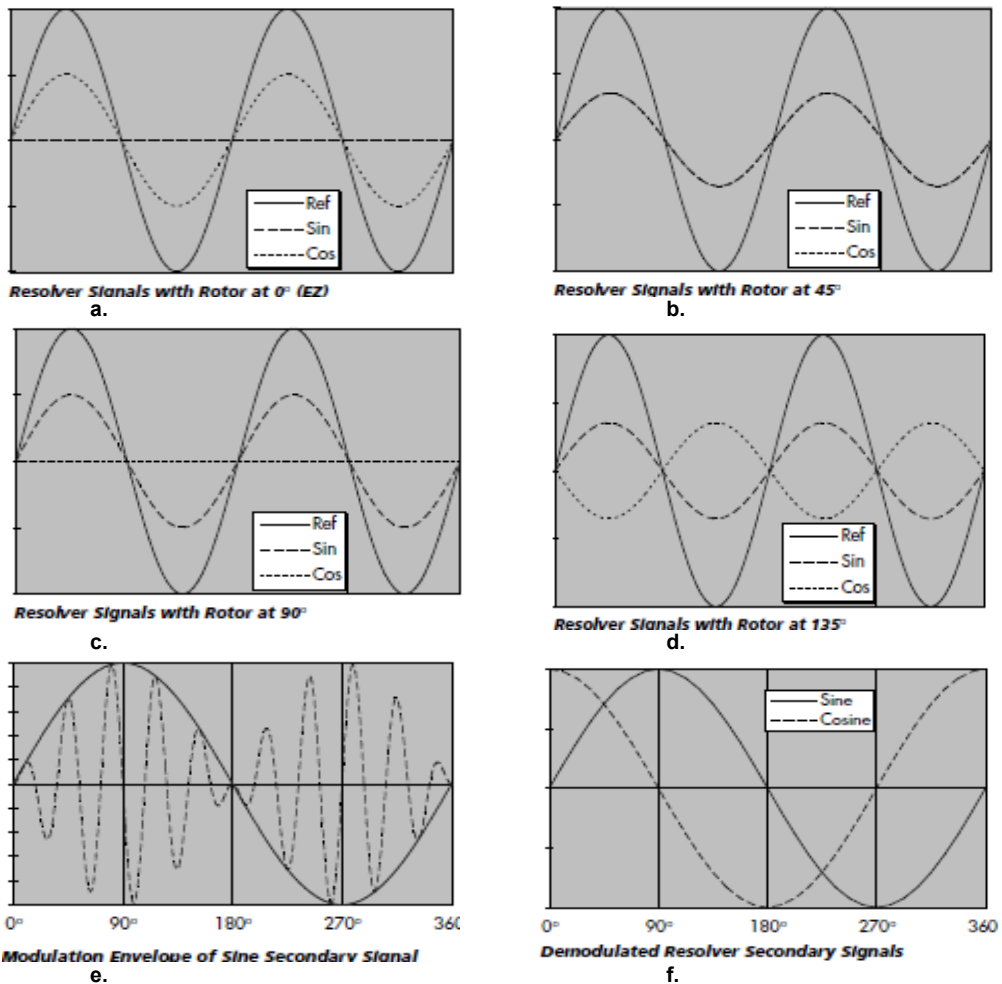
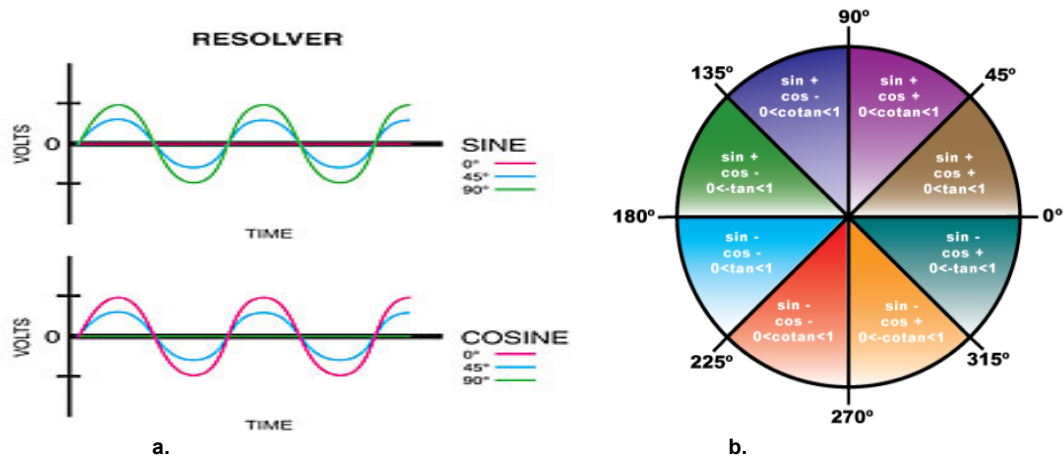


Fig. 2

- a. Schematic on construction of brushless transmitter resolver**
- b. Schematic on construction of brushless receiver resolver**



While it is helpful to know how the resolver signals appear as functions of time since that is what one sees when one looks at them with an oscilloscope, it is often more convenient to work with the envelope (amplitude at the reference frequency) of the signals with respect to rotor position. Shown in fig. 4e is the envelope of the sine secondary signal with respect to rotor position. The process of removing the carrier signal—leaving just the envelope—is called demodulation and is performed by the Resolver-to-Digital (R/D) converter. The demodulated sine and cosine resolver signals are shown in fig. 4f.

The resolver-to-digital converter performs two basic functions: demodulation of the resolver format signals to remove the carrier and angle determination to provide a digital representation of the rotor angle. The most popular method of performing

these functions is called ratiometric tracking conversion. Since the resolver secondary signals represent the sine and cosine of the rotor angle, the ratio of the signal amplitudes is the tangent of the rotor angle. Thus the rotor angle, θ , is the arc tangent of the sine signal divided by the cosine signal:

$$\theta = \arctan(\sin(\theta) / \cos(\theta)) = \arctan(V_s/V_c)$$

The ratiometric tracking converter performs an implicit arc tangent calculation on the ratio of the resolver signals by forcing a counter to track the position of the resolver. This implicit arc tangent calculation is based on the trigonometric identity:

$$\sin(\theta - \delta) = \sin\theta \cos\delta - \cos\theta \sin\delta$$

This equation says that the sine of the difference between two angles can be calculated by cross multiplying the sine and cosine of the two angles and subtracting the results. Further, as long as the difference between the two angles is relatively small ($\delta = \theta \pm 30^\circ$), the approximation $\sin(\theta - \delta) \approx \theta - \delta$ may also be used, further simplifying the equation. Thus, if the two angles are within 30° of each other, the difference between the angles can be calculated using the cross multiplication shown above.

In the R/D converter, this equation is implemented using multiplying D/A converters to multiply the resolver signals (proportional to $\sin \theta$ and $\cos \theta$) by the cosine and sine of the digital angle, δ , which is the output of the converter, as shown below. The results are subtracted, demodulated by multiplying by the reference signal, and filtered to give a DC signal proportional to the difference or error between the resolver angle, θ , and the digital angle, δ . The digital angle, δ , stored in the counter, is then incremented or decremented using a voltage controlled oscillator until this error is zero, at which point $\delta = \theta$ (the digital angle output of the converter is equal to the resolver angle). This incrementing and decrementing of the digital angle, δ , causes it to track the resolver angle, θ , hence the name of this type of converter.

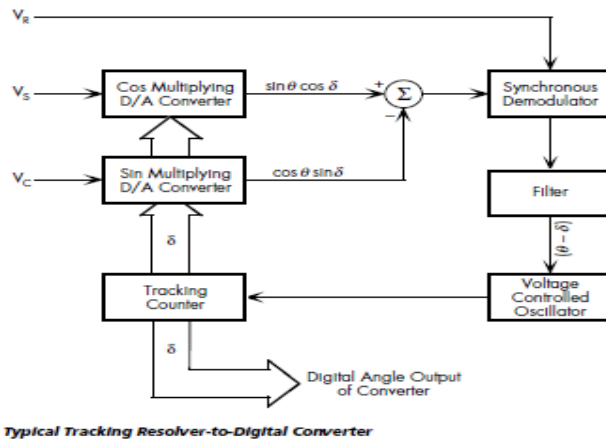


Fig.5 Schematic on operating principle of analogue – digital converter (resolver to digital converter)

Above were presented some general aspects on bipolar resolver. But, to increase the accuracy, the resolver is built in a version with more poles – 4, 8, 16, or 32 pairs (p) of poles. On this way, the resolver is loosing the absolute character and it is necessary to add a supplementary set of windings in a bipolar configuration. In this situation, the operating main and simplified equations are:

Primary Input: $V(R1-R2) = V_R = E_{1max} \sin \omega t$
 Sine Secondary: $V(S2-S4) = V_S = V_R TR \sin(p\theta)$
 Cosine Secondary: $V(S1-S3) = V_C = V_R TR \cos(p\theta)$
 $p\theta = \arctan(\sin(p\theta) / \cos(p\theta)) = \arctan(V_s/V_c)$

2.2. Typical windings for resolver

The topology of windings used in resolvers has a sinusoidal character that means a non homogenous distribution of wiring in different slots – the distribution is according with a sinusoidal rule to obtain as final effect an output signal very closed with a sine form. However, using only a sinusoidal type of winding do not solve completely the problem because there are other many factories that influence the accuracy level of resolver, as; quality of magnetic material, using slot solution, mechanical building asymmetries, the influence of the temperature on the material properties and winding characteristics etc. Some from these factories are controllable, but some of them are random. It is very important to take into consideration the controllable factories even from design stage, to reduce at minimum their influence.

In a bipolar resolver (absolute character), a frequent solution used to obtain a good accuracy is a lamination having many slots, to be possible to do better sinusoidal distribution.

If we discuss about multipolar resolvers, the number of slots per pol, from phisical point of view, is limited, frequently between 1 and two. In this situation, a special winding schema is used, but the final accuracy is a basis accuracy (two poles) divided at number of pole pairs (p).

Below it is shown an example of sinusoidal winding, in a concentric configuration, used for bipolar resolver (when it is possible to have more slots per pole). Let us to consider a winding having $4k$ slots, as it is shown in fig. 5. The concentric windings have different dimensions (paths), from $1 \div 2$ to $1 \div k+1$. The windings from the slots j , $(j, 2k-j)$ and $(2k-j, 2k+j)$, have the same numbers of turns $N_j / 2$, and are equally distanced from the two poles.

If we consider to have W turns per pole, so:

$$\sum_{j=1}^k N_j = W / 2,$$

Also, let us to consider that at a moment of time - t_0 – the electric current trough winding is $I \sqrt{2} \sin \omega t_0$.

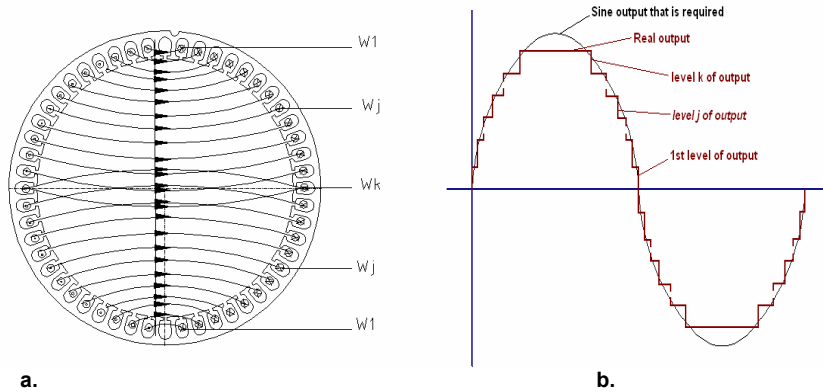


Fig. 6 Relative to a sinusoidal winding, in bipolar concentric configuration, for a construction with 4k slots

Using the fundamental relationships from magnetism, we can write for winding no. j , placed above Ox axis:
 $B_j(\theta, t_0) = \mu_0 N_j I \sqrt{2} \sin \omega t_0 / 2\delta$, for $\theta \in [j(2\pi/4k), \pi - j(2\pi/4k)]$
 and $B_j(\theta, t_0) = -\mu_0 N_j I \sqrt{2} \sin \omega t_0 / 2\delta$, for $\theta \in [\pi - j(2\pi/4k), j(2\pi/4k)]$, respectively:
 $B_j(\theta, t_0) = \mu_0 N_j I \sqrt{2} \sin \omega t_0 / 2\delta$, for $\theta \in [-j(2\pi/4k), \pi + j(2\pi/4k)]$
 and $B_j(\theta, t_0) = -\mu_0 N_j I \sqrt{2} \sin \omega t_0 / 2\delta$, for $\theta \in [\pi + j(2\pi/4k), -j(2\pi/4k)]$, for winding no. j placed below Ox axis.

We assume that $j=1,2,\dots,k$ and δ = air gap of the resolver.
 The configuration of magnetic field will result using a superposition method:
 $B_j(\theta, t_0) = 2 \sum_{j=1}^k B_j(\theta, t_0)$, for $j=1,2,3,\dots,k$
 The diagram of this field is shown in fig. 6b.

To find the right number of turns for any slot, we have to do a Fourier analysis of the above function and we have to assume that first $k-1$ odd harmonic components must be null. Finally, we find for N_j :

$$N_j = W / 2 \sin(j\pi/2k) / [\sum_{i=1}^k \sin(i\pi/2k)], \quad j=1,2,\dots,k$$

2.3. Some consideration regarding vectorial measurement methods

Testing resolvers at very small angular increments or at better than 1 arc-second (.00028 degrees) accuracy requires a high precision instrument. A high precision ratio transformer can provide the accuracy and resolution needed for testing resolvers at small angular increments. This document discusses how a precision ratio transformer can be used as a standard for synchro resolvers. To check the angular accuracy of a resolver the AC reference, resolver, ratio transformer and a phase angle voltmeter (PAV) are connected as shown in Figure 1. S4 of the resolver is connected to the input of the ratio transformer. S1 is connected to one of the PAV signal input terminals. S3 and S2 are connected to the common input of the ratio transformer. The shaft is precisely set to a known angle. The ratio transformer is an AC voltage divider; it is set to the tangent of the shaft angle. S4

is multiplied by the ratio setting of the ratio transformer. Since S4 is the cosine output of the resolver, the output of the ratio transformer should equal the sine output. [$\tan(\theta) = \sin(\theta) / \cos(\theta)$, or $\sin(\theta) = \tan(\theta) \cos(\theta)$]

S1 is the sine output of the resolver; the output of the ratio transformer should equal the S1 output of the resolver. If the two outputs are equal, the PAV will indicate a null condition. If the PAV does not indicate a null condition, the setting of the ratio transformer is adjusted until a null condition is indicated. The arctangent of the ratio transformer setting is the angle that the resolver output is indicating. On the other hand, for different positions of resolver rotor relative to resolver stator, the measurement system measures and computes:

$[\tan(\varphi)]_{\sin} = (U_{\sin})_f / (U_{\sin})_q$ si $(U)_{\sin} = \text{sqrt}((U_{\sin})_f^2 + (U_{\sin})_q^2)$, respectively
 $[\tan(\varphi)]_{\cos} = (U_{\cos})_f / (U_{\cos})_q$ si $(U)_{\cos} = \text{sqrt}((U_{\cos})_f^2 + (U_{\cos})_q^2)$, where:

- $(U_{\sin})_f$ = the part of sine output having the same phase with input
- $(U_{\sin})_q$ = the part of sine output having 90° phase shift with input
- $(U_{\cos})_f$ = the part of cosine output having the same phase with input
- $(U_{\cos})_q$ = the part of cosine output having 90° phase shift with input

For example, if a resolver shaft were set to angle of 20°, the ratio transformer would be set to the tangent of 20° which is 0.3639702. The null meter does not indicate a null and the ratio transformer are adjusted until it does. The final setting of the ratio transformer is 0.3639200; the arctangent of that value is 19.9975°. The resolver error is therefore 0.0025°, that means -9 arcseconds.

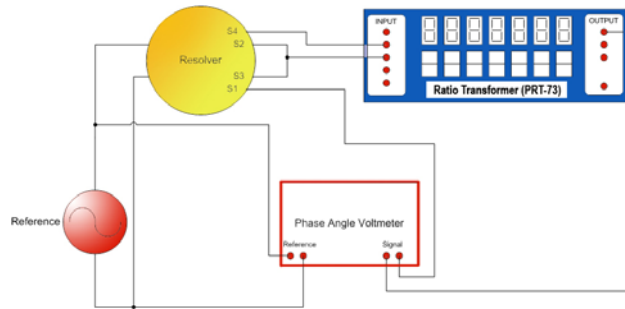


Fig. 7 Schematic on the stand to do a vectorial measurement of resolvers

2.4. Aspects on resolver accuracy

The accuracy of the resolver has to be analysed in connection with the configuration of resolver and application.

If a single phase resolver is used, we can consider only the error relative to the fidelity of the signal according with ideal sinus form. Let us consider that the induced voltage when the load of resolver is null can be expressed: $E_{bo} = VR TR \sin(\theta)$. On the other hand, the induced voltage in load conditions can be expressed: $E_b = VR TR \sin(\theta) - j X I \cos^2(\theta)$. The last relation can be expressed and as: $E_b = E_{bomax} \sin(\theta) / (1+b \cos^2(\theta))$. On this way, we can define a relative error as: $\Delta E_b = (E_{bo} - E_{br}) / E_{bomax} = (b \cos^2(\theta) \sin(\theta) / ((1+b \cos^2(\theta)))$. In the most part of applications, are used both windings, so we have to consider the differences between the amplitude of the two signals, as well as the error of quadrature.

The main factories that are influencing the accuracy are: - the status of general machining (technologies, mechanical accuracy, heat treatment etc.), than the quality of the materials; - the total impedance of the measurement system; - excursion of amplitude of input voltage, as well as the value of the input frequency; - excursion of the temperature during operating; - speed of rotation of the resolver etc.

2.5. Using the resolver as transducer of linear rotating position

There are many applications where it is needed an output voltage linear relative to angular position. To solve this problem, we have to obtain an output having the following expression:

$$U(\theta) = \sin(\theta) / (1 + A \cos(\theta))$$

We can see that the above expression is a tangent, but $\cos(\theta)$ must be replaced with $(1 + \cos(\theta))$, that can be obtained from the two outputs of the resolver.

If **A** has any value between **[0.50 , 0.58]**, the above function is a linear one. The error is under **2%** if $\theta \in [-80^\circ , 80^\circ]$, or under **0.06%** if $\theta \in [-60^\circ , 60^\circ]$ and **A = 0.54**.

3. Some aspects on microsyn

The microsyn developed by the authors is a position inductive transducer that has two magnetic parts (rotor and stator) and two windings (one for excitation and another one for control) per any pole pair on the stator. It is to remark that the rotor is not wined, so, the microsyn is naturally in brushless configuration.

The operating principle is as following:

- the excitation winding is supplied with a voltage:

$$V_E = E_{1max} \sin \omega t$$

- rotating the rotor, in the control winding is induced a voltage having a linear evolution relative to the position between the rotor and stator: $VS = VR TR p\theta$
- the output voltage is increasing linear to a value of electrical angle (25° to 40° , depending of the configuration of the microsyn), than there is a kind of saturation, but the voltage is increasing till 4, than there is a kind of saturation, but the voltage is increasing till 45° , than the voltage is decreasing
- we can see that the typical microsyn operates only between maximum 90° electric, but only maximum 84° electric as linear transducer
- the authors had developed a microsyn operating as linear transducer for 106° electric (-53° to 53°).

3. Results. Conclusions

The authors are working from long time as researchers, designers and producers of special electric machines. In these conditions, the resolver was one of main components to develop, to design and to produce. Different configurations, different sizes and different parameters are subjected with the author's activity. Bipolar resolvers 05, 08, 11, 15 or bigger sizes were developed for different applications in naval, airborne, terrestrial fields. 20 seconds of arc or 1 minute of arc accuracy were obtained on resolvers 19 or 29 sizes, having 32 poles. The methods of design used the most modern concepts, including numerical analysis of electromagnetic field. The methods of testing are based on vectorial measurement systems.

As conclusion, we can remark that the resolver component is superior to many other kind of absolute or relative position transducers because of its ruggedness and ability to provide a very high degree of angular accuracy under severe conditions. There are not optical parts to keep clear of smoke or oil that often disrupt the operation of optical encoders. Because the resolver has two outputs that are subjected to tangent function, the input signal anomalies have a low influence. The resolver saves size and weight, being substantially smaller than other transducers approaches and easily integrated into any system.

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CONSIDERATIONS REGARDING EXHAUST GAS RECIRCULATION AND HUMID AIR MOTOR

Daniel MĂRĂȘESCU¹
Sebastian ZĂICEANU²

¹ Asp.ing. Academia Navală Mircea cel Bătrân

² Lt(r). drd. ing. Academia Navală Mircea cel Bătrân

Abstract: *There is international effort focused on the reduction of gaseous emissions that contribute to global warming and atmospheric pollution. Ships are responsible for a portion of this pollution contributing to environmental degradation. Exhaust from marine diesel engines includes air pollution in the form of nitrogen oxides, carbon oxides, unburned hydrocarbons and particulate matter. These have been proven to have a negative impact on health and the environment. Increasingly, these marine sources are being targeted for reduction.*

Keywords: *pollution, fuels, water, burning*

1. Introduction

The worldwide focus on fuels is generally increasing because of the focus on exhaust gas emissions.

During more than 10 - 15 years, the authorities have been focused on establishing rules for the exhaust gas emissions from marine engines. Hence, the marine industry is under international regulation.

Compliance with IMO Annex VI requires the engines to be within the given NO_x level limits documented in a technical file following the engine in operation. In order to give operators a unified technical file to be followed by MAN B&W licensees, a procedure has been developed by MAN B&W and accepted by the flag states representatives, the Classification Societies.

Until now, local rules have been introduced for areas such as Sweden, Norway, and the harbour of Hamburg, where for example a harbour-fee reduction is used as an incentive for the use of low-sulphur fuel, but with limited impact on the environment, especially with regard to emissions from ships in international operation.

A general worldwide emissions limitation seems to be the only way that all countries can benefit from a reduction in emissions. Emission limits must follow state-of-the-art technology and the ability of the market to adapt to such limits.

It is correct that emission limits can force the technology to be developed, but then the solution chosen will not necessarily be the optimum one. And the system chosen on ships built will, on average, stay there for the ship's lifetime, which can be more than 25 years.

2. NO_x formation

There are a number of different formation mechanisms responsible for NO_x in combustion processes. The relative importance of these different mechanisms is strongly affected by the temperature, pressure, flame conditions, residence time and concentrations of key reacting species.

2.1. Thermal NO

The thermal mechanism, also known as "extended Zeldovich mechanism", is responsible for the majority of NO_x emissions from diesel engines when peak combustion temperatures exceed 2000 K.

Since temperatures of this magnitude are desirable to maximize engine efficiency, this mechanism has been studied extensively and is fairly well understood. The three chemical reactions that are important in this mechanism are:



The overall reaction rate for this mechanism is slow and it is very sensitive to the temperature. As a consequence, thermal NO only appears in significant quantities in the post combustion. Also, the actual NO concentration from this mechanism deviates significantly from equilibrium concentrations.

This gives this mechanism a very strong time dependence that is important for low speed engines.

2.2. Prompt NO

The prompt NO mechanism, also known as the "Fenimore mechanism", is very rapid and results in NO formation in the combustion zone. The most important pathway for prompt NO is initiated by the rapid reaction of hydrocarbon radicals from the fuel with molecular nitrogen, leading to the formation of amines or cyano compounds that subsequently react to form NO. The most important initiation reaction for prompt NO is:



Subsequent rapid conversion to NO is strongly affected by O and OH. Prompt NO is most significant when combustion occurs at fuel concentrations higher than stoichiometry where there is a high concentration of hydrocarbon radicals to form HCN and the concentrations of O and OH are still high enough to cause the HCN to proceed to NO through the following reaction sequence:





2.3 N₂O pathway

Another NO formation mechanism important in combustion is the N₂O pathway. The initial reaction for this pathway is the three body reaction:



While N₂O generally reverts back to N₂, this is not always the case. Under conditions where the air/fuel ratio is lean, NO can form through either of the following two reactions:



This NO formation route is fuel and pressure dependent. At higher pressures and lower temperature, the three-body initiation becomes competitive with the O + N₂ reaction in the thermal mechanism. These are the most important formation mechanisms.

3. Regulations

There are a number of national and international regulatory organizations that propose limitations on NO_x as well as other harmful emissions. The International Maritime Organization (IMO), through the International Convention for the Prevention of Pollution from Ships (MARPOL, Annex VI) regulates this on a global level. They have developed an approach to reducing green house gas (GHG) emissions, including NO_x. Member countries of the IMO must therefore adhere to the regulations that they have put forth. However, some organizations have committed to adopting regulations that are more stringent.

The MARPOL, Annex VI, NO_x emission limits are:

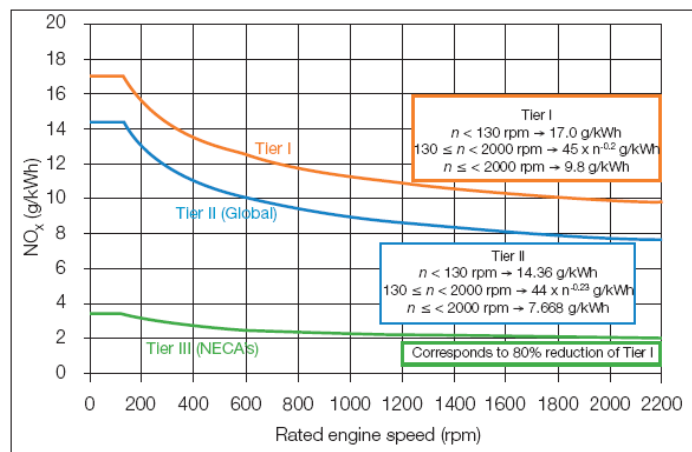


Fig.1. NO_x emissions

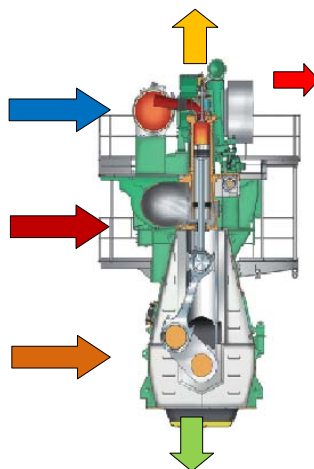


Fig.2 Emissions resulted from the diesel engine

4. Exhaust Gas Recirculation (EGR) and Humid Air Motor (HAM)

For both the Exhaust Gas Recirculation (EGR) and the so called Humid Air Motor (HAM) systems, the NO_x reduction effect is achieved by reducing the local maximum combustion temperatures in the combustion chamber, and reducing the concentration of oxygen by the addition of inert media with high specific heat:

- exhaust gas;
- water vapour.

The NO_x production only takes place at very high temperatures (2,200°K and above), and it increases exponentially with the temperature. The EGR method is based on a reduction of the oxygen content in the cylinder charge, and the HAM method is partly based on reducing the oxygen content of the cylinder charge and partly on increasing the heat capacity of the cylinder charge by the addition of water vapour.

As mentioned above, these methods (EGR and HAM) have, by calculations and tests, proved their capability for NO_x reduction, but they have never before been developed to a commercial application level for large two-stroke engines, and they have not been fully optimized with regard to cross-over effects on fuel oil consumption, heat load conditions and other emission parameters.

After careful evaluation of the EGR and HAM methods, we concluded that recirculation on the high-pressure side from the exhaust receiver to somewhere in the scavenge air system after the turbocharger compressor, with assistance from an EGR blower, would be the most suitable EGR solution. Furthermore, high-pressure side water spray humidification would be the most suitable HAM solution for our two-stroke engines.

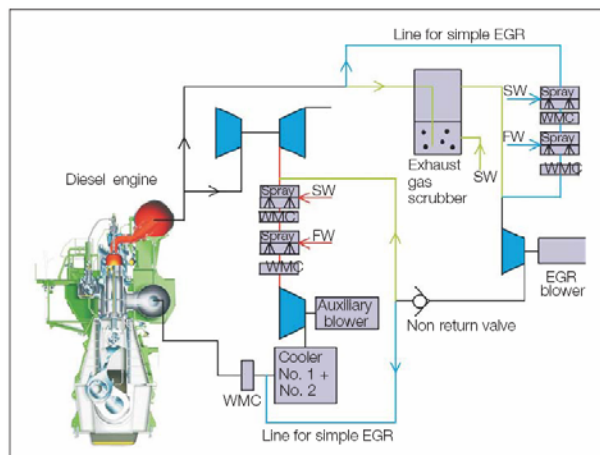


Fig.3 Schematic design of EGR and HAM Systems

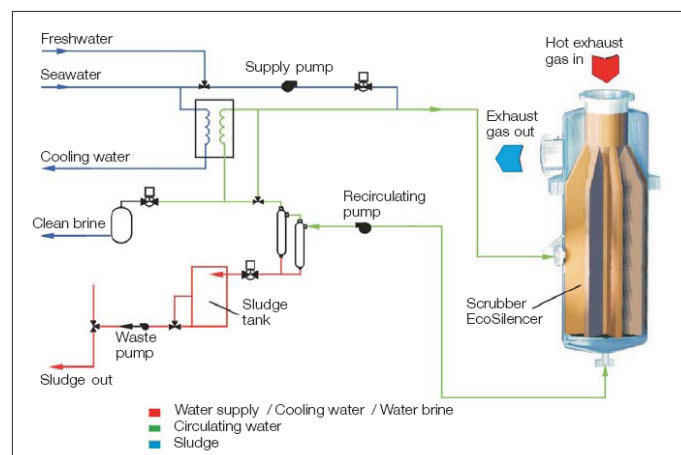


Fig.4 Bubble-bath scrubber (EcoSilencer) and Water Treatment Skid.

5. Results from engine testing with EGR systems

Very promising operating conditions have been obtained during the tests, as outlined in the below summary of the main results. As can be seen, at increased recirculation amounts, the HC and PM emissions are reduced corresponding to the reduction of the exhaust gas flow from the engine. This indicates that each engine cycle has the same production of HC and PM independent of the recirculation amount, and that the HC and PM in the recirculation gas is eliminated during the normal combustion process. The increase in CO emissions with increased recirculation amount indicates, as expected, that the lower cylinder excess air ratios at increased recirculation amount result in larger local regions in cleaning the exhaust gas with scrubber. As mentioned in the description of the EGR system, the EcoSilencer has been introduced in the EGR system to clean the exhaust gas and, if possible, also to reduce some of the emission components.

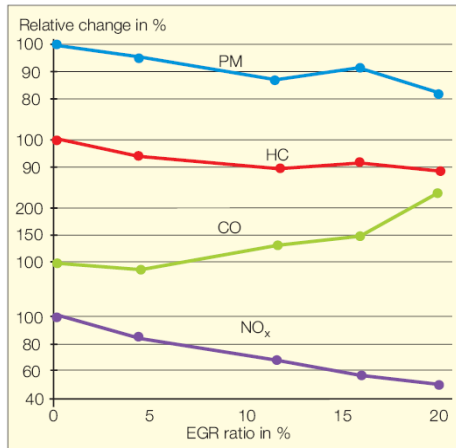


Fig.5. EGR System

MAN B&W Diesel has accordingly measured the emission components at inlet and outlet of the scrubber at different engine loads. The results from these measurements indicate that scrubbing reduces PM emission to 20-25% (highest at low loads and lowest at high loads) and that HC and CO pass the scrubber nearly unaffected. The NO₂ fraction of the NO_x is, as expected, dissolved in the water, and the NO fraction of the NO_x passes the scrubber nearly unaffected.

4. Results from engine testing with HAM systems

As for the EGR system also for the HAM system very promising operating conditions have been obtained, as outlined in the following.

The measured emission parameters, as a function of the HAM level at 100% engine load, are illustrated in Fig. 6. As can be noted, the HC and PM emissions are nearly unaffected by the HAM level. The CO emissions increase significantly with increased HAM level, most likely due to the lower cylinder excess air ratios at increased HAM levels, which result in larger local regions in the combustion chamber with lack of oxygen. Furthermore, the expected significant reduction of the NO_x level has been confirmed that combustion chamber with lack of oxygen. Furthermore, the expected significant reduction of the NO_x level has been confirmed.

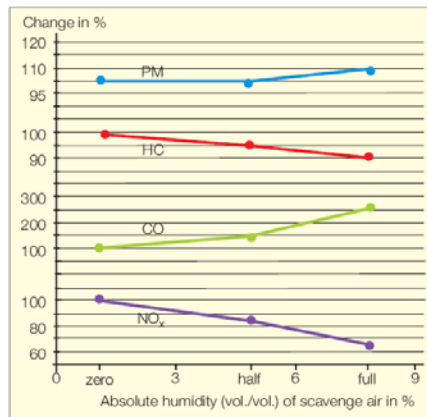


Fig.6. HAM System

5. Conclusions

The precursors to the formation of nitrogen oxides during the combustion process are nitrogen and oxygen. Together these compounds comprise 99% of the engine intake air. Oxygen will be consumed during the combustion process, with the amount of excess oxygen available being a function of air/fuel ratio with which the engine is operating under. The nitrogen remains largely unreacted in the combustion process; however a small percentage will be oxidized to form various oxides of nitrogen. The nitrogen oxides (NO_x) which can be formed include NO and NO₂, while the amounts are primarily a function of flame or combustion temperature and, if present, the amount of organic nitrogen available from the fuel.

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THE GENERATION OF WATER/FUEL EMULSIONS

Corneliu MOROIANU¹

¹“Mircea cel Bătrân” Naval Academy, Constanța, Romania

Abstract: *This paper presents a possibility of producing the water-heavy fuel emulsions by means of ultrasounds.*

Keywords: *ultrasonic vibration phenomenon, water-heavy fuel emulsions, ultrasound propagation.*

1. Introduction

The emulsion is an heterogeneous system consisted of, at least, an unmiscible liquid intimately dispersed in another one under the form of some drops with a diameter over 0.1mm. These systems have a minimum stability which can be increased by additives like surface-active agents, finely powdered solid particles etc. The reference to the particle dimensions of dispersed phase makes a distinction between the emulsify phenomenon and the solubilization one. The emulsions are considered heterogeneous systems which belong to the pseudocolloid category. In the analysis of emulsions it is necessary to differentiate the emulsion phases. The phase that is under the form of some fine drops is named the disperse phase or the internal phase. The phase that forms the matrix in which these drops are suspended, is called the continuous phase or the external phase. Also, the internal phase is named the discontinuous phase while the external phase is called the non-disperse phase.

Classically, there are two types of emulsions, starting from the known case of water-oil emulsions. When the disperse phase is oil, then it is the oil-water emulsion and it is noted with the symbol O/W. When the disperse phase is water, it is the water-oil emulsion noted with the symbol W/O. This terminology is conveniently applied even in the case in which the emulsion phases are not, strictly speaking, oil or water.

2. The ultrasound action in liquid media

To understand the ultrasonic vibration phenomenon, it is analyzed the simple case in which the oscillation source is a pulsating piston placed in front of a pipe. It has been found the propagation of plane waves in the pipe and the existence of a series of normal planes on the pipe axis, in which the substance is, at one time, in a state of compression or dilatation. Two states of maximum (minimum) compression are separated by an equal distance with a wavelength, λ , and we have the relation:

$$T = \frac{1}{\nu} \quad (1)$$

where:

T – the period of time [s];

ν – the frequency of oscillation [1/s].

The common phenomena of reflection, refraction and diffraction are produced as in the case of light vibrations. If we place a reflecting plane at the pipe end, the reflected waves interfere with the incident waves to form a stationary wave system in which double amplitude modular oscillations take place; if the reflector is perfect, the oscillations are generated on the both sides of the planes placed at the distance of $\lambda/4$ named nodal planes and vertical planes.

Each of the two planes with the same name are separated by a distance $\lambda/2$. We can consider instead of a vibratory piston, a pulsating sphere similar to a punctiform light source generating spherical waves. This case is nearer to the practice and leads to the same arguments generated by optics.

The molecular vibration corresponding to the acoustical phenomenon is accompanied by a dissipation of thermal energy. A decrease of amplitude takes place depending on the vibration frequency and the nature of the vibratory body. When the vibration falls over a surface, a radiation pressure is developed, as in the case of the light but with a different order of magnitude.

To describe the state of vibratory medium particles, we take:

- the motion amplitude, A – the maximum deflection on the propagation axis;

- the pressure amplitude, P;

- the velocity amplitude, v , as these particles vibrate with a certain frequency (sinusoidal time function);

- the acceleration amplitude, t .

In the medium, there is a certain density of energy, w , which is the energy contained in the volume unit of the medium. When the vibration is propagated under the form of travelling plane waves, at the crossing the surface unit, a certain quantity of energy passing in a second is given by:

$$w = \frac{I}{\nu}; \left[\frac{J}{m^3} \right] \quad (2)$$

The vibration amplitude is related to the acoustic intensity, I, by the following relations:

$$I = \frac{1}{2} \cdot \rho \cdot v \cdot A^2 \cdot \omega^2 = \frac{1}{2} \cdot \frac{p^2}{\nu \cdot \rho} = \frac{1}{2} \cdot \rho \cdot v \cdot \gamma^2 \quad (W/m^2) \quad (3)$$

where:

ρ – the medium density [kg/m³];

ω – the pulsation $\omega = 2 \cdot \pi \cdot \nu$.

To simplify, we shall use the following notations:

The ultrasonic activation process of the liquids is based on the cavitation phenomenon. When an acoustic pressure changing from positive values to negative values acts on a liquid, the liquid volume is put to compression and dilatation, at the same time. When a maximum pressure is reached, in the points where the cohesion is weak, a liquid breakage is produced. This breakage is followed by an overpressure in the point where it has occurred, finding the presence of some cavities. In these hollows, the liquid-dissolved gases, under the form of bubbles which blow up after a short time, generate local pressures

of tens of bars. As on the surface and inside the bubbles there are contrary electric charges, with the explosion, the lightning discharges are generated. These produce an ionization of surrounding particles and an emission of ultraviolet rays. The cavitation process is influenced by the frequency and the intensity of ultrasounds. The higher the limit intensity, the higher the ultrasound frequency. The appearance of cavitation in a liquid depends, to a great extent, on the existence of liquid-suspended undissolved gases. The cavitation can be obtained with acoustic pressures lower than 20 bars and in this case, the well-differentiated points appear in the liquid, named nuclear centres. These inhomogenities localized in a liquid form the place of cavitation process. If in a liquid there are introduced particles from another liquid which is unmiscible with the first one, the liquid resistance is reduced, being possible that the included gas molecules to separate the liquid from the particles introduced on their surface. The presence of gas seems to play the role of a real catalytic agent of cavitation formation. The cavity bubble is developed up to a certain extent which, at a certain pressure, depends on the developing time and the ultrasound frequency. The time, t , necessary for the development of spherical cavity bubble from the initial radius R_0 to R is given by the relation:

$$t = \sqrt{\frac{3}{2} \cdot \rho \cdot R_0^2} \cdot \int_{R_0}^R \frac{d\left(\frac{R_0}{R}\right)}{\left(\frac{R_0}{R}\right)^2 \cdot \sqrt{\left(1 - \frac{R_0}{R}\right) \cdot \left[\left(\frac{R_0^2}{R^2} + \frac{R_0}{R}\right) \cdot (R_0 \cdot P + 3 \cdot \tau) - R_0 \cdot P\right]}}; \quad (4)$$

where:

ρ - the liquid density [kg/m³];
 P - the hydrostatic pressure [daN/mm²];
 τ - the surface liquid pressure [N/m].

In the following phase, after the relative slow dilatation of the cavity bubble, its sudden compression and its quick destruction are produced. The compression time of the bubble from a radius R_m to a radius R can be calculated by the relation:

$$\tau = R_m \cdot \sqrt{\frac{3 \cdot \tau}{2 \cdot P}} \cdot \int \frac{\left(\frac{R}{R_m}\right)^{\frac{3}{2}} \cdot d\left(\frac{R}{R_m}\right)}{\sqrt{\left(1 - \frac{R}{R_m}\right) \cdot \left[\left(\frac{R}{R_m}\right)^2 + \left(\frac{R}{R_m} + 1\right) \cdot \left(1 + \frac{3 \cdot \tau}{R_m \cdot P}\right)\right]}}; \quad (5)$$

As a result of the cavity bubble destruction, the gas or the existing vapours inside it are adiabatically compressed, the temperature can reach 1000°C and a shock wave is generated of which intensity increases with the increase of acoustic pressure. The generation of acoustic cavitation in a liquid causes a series of mechanical, acoustical, optical and chemical effects.

3. The ultrasound propagation in inhomogeneous liquid media specific to the residual heavy fuels

The actual media of propagation are not homogeneous which leads to some changes in the wave propagation. This situation often appeared in the ultrasonic techniques consists of the propagation of longitudinal plane wave beam to a normal direction on the interface of two infinite media with the characteristic impedances $\rho_1 c_1$ and $\rho_2 c_2$ where:

ρ - the liquid density [kg/m³];
 c - the propagation velocity of the ultrasonic wave [m/s].

On the interface, the wave undergoes a reflection and a partial transmission of energy in the latter medium, the acoustic intensities proper to the two fractions being dependent on the acoustic parameters of the two media. The reflection and the transmission are evaluated by means of the reflection and transmission factors, respectively. The acoustic reflection factor is defined by the ratio of reflected wave intensity to incident wave intensity:

$$r_a = \frac{I_r}{I_i} = \frac{(\rho_1 \cdot c_1 - \rho_2 \cdot c_2)^2}{(\rho_1 \cdot c_1 + \rho_2 \cdot c_2)^2}; \quad (6)$$

The acoustic transmission factor is defined by the ratio of transmitted wave intensity to incident wave intensity:

$$t_a = \frac{I_t}{I_i} = \left[\frac{4 \cdot \rho_1 \cdot c_1 \cdot \rho_2 \cdot c_2}{(\rho_1 \cdot c_1 + \rho_2 \cdot c_2)^2} \right]^2; \quad (7)$$

The two factors are correlated to the relation:

$$r_a + t_a = 1 \quad (8)$$

From this relation, it results that for two equal impedance mechanisms $r_a=0, t_a=1$, the entire acoustic energy is transmitted in the latter medium. On the other hand, the more different the impedances of the two media are, the higher the reflection factor and the lower the transmission factor. The propagation velocity of longitudinal waves depends on the temperature and the speed, decreasing according as the liquid temperature increases. Also, the propagation velocity of wave varies with the pressure applied on the liquid, that is, up to 500 [daN/mm²], the speed linearly increases with the pressure and at high pressures of 104 [daN/mm²] it reaches the limit value specific to the liquid. The ultrasound energy, as a result of passing through a liquid, besides the generation of cavitation phenomena, interface friction, acoustic pressure and radiation, it is also the reason for ultrasound absorptive.

4. The ultrasonic emulsification process

The formation of emulsions by means of ultrasounds is due to the cavitation phenomenon. An ultrasound wave passing through a liquid puts it to a compression and a dilatation, successively. When the dilatation is moderate and the liquid doesn't contain any gas, nothing is happened. If the liquid is gas-saturated, there are bubbles of that gas. The liquid disrupts under the action of ultrasound vibrations resulting cavities in the liquid. Rayleigh has calculated the pressure appeared at a bubble implosion in a liquid; it can be of some thousands of bars. These forces can be able to generate any mechanical effects, including dispersion. On the other hand, this intense agitation which is determined by these effects, can lead to the increase of number of collisions of dispersed particles, and in this case, the emergence probability of coalescence increases.

In fact, from this point of view, the ultrasonic emulsification process represents a competition between opposing forces and for that reason, it is necessary to choose the working conditions and the frequencies, so that the disruptive effect should be prevailing. To prepare an emulsion, the limit value of ultrasound intensity must be exceeded, specific to the type of emulsion. So, to produce an emulsion of O/W type, the limit acoustic intensity is more reduced than that necessary to prepare an emulsion of W/O type. The type of acoustic field influences the emulsification process, that is, by applying some travelling ultrasonic waves, the process efficiency is increased as compared to the application of some stationary waves. This is explained by the fact that in a field of stationary waves, the process opposed to dispersion, namely, coagulation prevails. In the case of stationary waves, the emulsification process is of low quality than that in the case of travelling waves. Unlike the case of stationary waves where in the emulsification process the coagulation phenomena prevail, in the case of travelling waves, the small particles (0.5 - 1.0µm) are prevalent.

The ultrasound frequency determines the type of emulsion. As a rule, at low frequencies (15 – 25 KHz) the emulsions of O/W type are obtained and at high frequencies (200 – 300 KHz) the emulsions of W/O type are produced. The ultrasonic treatment time conditions the emulsification process which takes place after a certain period of time, longer in the case of emulsions of W/O type than that of emulsions of O/W type, and the moment of emulsion formation coincides with that in which the emulsion reaches a certain concentration. The duration of ultrasound application influences the dispersion degree and the emulsion homogeneity has a great importance for the emulsion quality; a too short time or a too long time can endanger the mean diameter value of the particles. In the first stage of the process (5 – 15 min.) the coagulation phenomena prevail and then, the dispersion becomes prevalent (after 25 – 30 min.), most of particles obtaining dimensions between 1.0 and 1.65 µm. By extending the time of ultrasonic process over 30 min., new instability phenomena occur beginning again the coagulation enhancement.

5. The generation of water/fuel emulsions by means of ultrasounds

The generation of high intensity ultrasounds in liquids was performed by means of hydrodynamic whistle for liquids. The hydrodynamic whistle for liquids, Fig. 1, is formed of a tapered nozzle (1) provided with a nipple which has in front of it, at a distance of 0,3 – 1 mm, a vibrator segment (2) fixed in one or two nodal points. Passing through the nozzle, the liquid jet hits the segment (fixed at an end on the bracket) which at a certain jet pressure (about 12-15 bar) resonating with its own frequency:

$$f = \frac{22,4 \cdot d}{4 \cdot \sqrt{3}} \cdot \frac{1}{l^2} \cdot \sqrt{\frac{E}{\rho}}, \text{ [Hz]} \tag{9}$$

where:

- l – the segment length [m];
- d – the segment thickness [m];
- E – Young's elasticity modulus [N/m²];
- ρ - density of segment material [kg/m³].

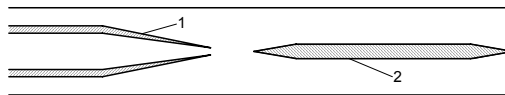


Figure 1 – Hydrodynamic generator for liquids; 1- snout, 2- elastic lamella.

When the resonator segment is made of steel, its resonance frequency is given by:

$$f = 5,4 \cdot 10^5 \cdot \frac{d}{l^2}, \text{ [Hz]} \tag{10}$$

The ultrasound frequency is a function of liquid jet pressure and so, the hydrodynamic generator effectively irradiates the ultrasounds in the working environment as long as the following relation is observed:

$$f = \frac{v}{h} \cdot 0,5 \text{ [Hz]} \tag{11}$$

where:

- v – is the flow rate in the nozzle [m/s];
- h – distance from the nozzle to the resonator segment [m].

The whole system formed of a nozzle and a vibrator segment is enclosed in a resonant chamber having an acoustical form, namely, dimensioned.

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ON THE EKMAN CURRENTS TRANSPORT ON THE ROMANIAN BLACK SEA SHORE

Angela MUNTEAN¹

¹Naval Academy “Mircea cel Batran” Constanta

Abstract: *The circulation of water on the Romanian Black Sea coast is not very well known. The wind driven circulation is a very important element of this circulation. Some theoretical calculi regarding the water transport of Ekman currents on the ocean regions with finite depths are presented. Those results are applied for Romanian Black Sea shore and are compared with some results obtained from observations.*

Keywords: *wind driven circulation, water transport, Ekman currents*

1. Introduction

Black Sea is a particular sea, with very low salinity, high stratification, so much so that surface waters and deep waters do not mix, thus leading to the fact that the latter have no or very low oxygen. It is located between latitudes of 41° to 46° N and longitudes of 28° to 41.5° E and it has a semi-enclosed basin and a small exchange in the straits. Because of those phenomena, the physical Black Sea water properties are unique. There is a strong density stratification due to the strong river discharges in the northwestern side of Black Sea (Danube, Dnepr and Dnestr). There exists an intensive water horizontal exchange between shelf and central regions. A proof of this is the low average salinity difference between the upper layer water in the central part of Black Sea and the coastal regions.

The upper layer circulation in the Black Sea basin is a dominant horizontal circulation which can be identified by a basin scale cyclonic boundary, the Rim Current system, which moves around the periphery, a cell with different structural organisations from two sub-basin scale cyclonic gyres to a series of large interconnected mesoscale cyclonic eddies on the interior of Rim Current and some quasi-stable/recurrent anticyclonic eddies on the coastal side of Rim Current.

The Rim current system is essentially driven by the mean cyclonic wind pattern. This current is a 40-80 km wide slope one, locked to the steep continental slope [1]. Direct observations of the current velocity suggest that the maximum speed of this current is usually 40-50cm/s increasing sometimes up to 80-100cm/s. The volume transport of the Rim current is estimated to be 3-4 Sv.

The circulation pattern is different during the four seasons. It can say that the circulation has a bi-modal character. The most intense currents are observed approximately three months later after intensification of the wind stress curl, the weakest currents are observed approximately three months after amplification of the wind stress curl.

For the full Black Sea basin, the vertical circulation ($\sim 10^5 \text{ m}^3/\text{s}$) is much weaker than the horizontal circulation ($\sim 5 \times 10^6 \text{ m}^3/\text{s}$) and comparable with the amount of water entrained by the Mediterranean plume [2].

The purely wind-driven circulation reveals most of the observed circulation features including a well-defined meandering boundary current system and subbasin scale cyclonic gyres forming the interior flow structure of the basin. Topography obviously remains a crucial factor in controlling the pattern of the persistent rim current system all year long. The dynamical instabilities of the rim current produce strong meandering and mesoscale eddies which often modulate the basin and subbasin scale structures of the circulation. The surface thermohaline fluxes generate simpler circulation patterns with a comparable strength but mostly in the opposite direction to the wind-driven circulation [3].

The wide northwestern continental shelf (mean depth $\sim 50\text{m}$) occupies the region between the Crimean peninsula and the west coast. This wide continental shelf extends along the western and southwestern coasts of the Black Sea with depth $< 100 \text{ m}$ at the shelf break. In fact the entire western Black Sea shelf extending from Crimea to the Sakarya River on the Anatolian coast is a continuous region of flat topography decreasing in width towards its southern terminus. The shelf becomes abruptly terminated at Sakarya Canyon, an abrupt feature where the depth suddenly increases from 100 m to about 1500 m along the Anatolian coast east of the Bosphorus [4].

The seasonal and annual changes in the fresh water supply of the Black Sea tributaries are very important for the level changes of the Black Sea (climate, exchange with other seas). Due to important river supplies the water budget of the Black Sea is exceeding. Under the influence of natural factors the long term variation of the sea level has a continuous rising trend. On the Romanian coast of the Black Sea the level can rise up to 60-80 cm [5].

On the Romanian Black Sea shelf some different characteristics of the water circulation are produced by the mixing of fresh with the salt water [6]. On average, the Danube river delivers 6300 m^3 water per second through the delta and into the Black Sea. The Romanian Black Sea shelf is a region with strong biogeochemical interactions between land and the central basin. The north-west Black Sea region is a lacustrine coast. The shores lie with continental structures where the water is shallow and sea bottom is graded. The Romanian Black Sea coast is 247 km long and is characterized by sandy coastal environments. The continental shelf is very large and the beaches are long and linear. The Romanian Black Sea coast can be divided in two main sectors. The first sector, between Danube Delta's Chilia branch and Cap Midia has a low level topography, beaches, sandy soils and sand banks. The second sector, in the south, between Cap Midia and Vama Veche, has a high level sea wall which is interrupted by beaches.

The recent studies prove that the deep flow in the Black Sea is very intense achieving a velocity up to 3-4 cm/s. Moreover the float being on the depth is transported along the isobaths. The topography control of the deep flow explains its intensity as the bowl-shaped bottom topography of the Black Sea is conditioned the intensification of deep currents [1]. Wind induced upwelling according to Ekman is the main process under investigations. The theoretical model results indicate that topographic variations do not change the total amount of upwelled water but redistribute it unevenly along the coast to form enhanced upwelling. The Ekman transports around the capes cause an alongshore pressure gradients which force a bifurcation of the flow field [7].

The large scale wind field is responsible for the Ekman induced upwelling whereas the small scale local wind stress place a relatively important role on the modification on the large-scale features.

2. The Ekman currents components

The system of equations of motion is obtained from Navier-Stokes ones. The vertical component of velocity can be neglected. The horizontal components of motion velocity are: u , v . The equations for the horizontal motion are written in the presence of two forces only: Coriolis force and frictional force. The general form of system of equations of motion is:

$$\begin{aligned} \frac{du}{dt} &= f v - \frac{1}{\rho_w} \frac{\partial p}{\partial x} + A_h \left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} \right) + A_z \frac{\partial^2 u}{\partial z^2} \\ \frac{dv}{dt} &= -f u - \frac{1}{\rho_w} \frac{\partial p}{\partial y} + A_h \left(\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} \right) + A_z \frac{\partial^2 v}{\partial z^2} \end{aligned} \quad (1)$$

where $f = 2 \omega \sin \varphi$ is the Coriolis coefficient (assumed constant), p the pressure, A_h , A_z eddy viscosities in horizontal and vertical directions, ρ_w the water density.

The coordinate system used is a rectangular one, with Ox to the east, Oy to the north and Oz up. The motion is considered driven by a wind blowing in the direction gives by an angle α with the north direction, with horizontal components τ_x , τ_y .

The boundary conditions are:

- at surface

$$\rho_w A_z \frac{\partial u}{\partial z} = \tau_x, \quad \rho_w A_z \frac{\partial v}{\partial z} = \tau_y, \quad \text{for } z = 0, \quad (2)$$

- at the bottom of the basin

$$u = v = 0.$$

If the basin has a constant depth the boundary condition for the bottom is

$$u = v = 0 \quad \text{for } z = -H.$$

The horizontal components of current speed are [8]:

$$\begin{aligned} u_E &= \frac{\tau}{\rho_w (\cos 2aH + \cosh 2aH)} \sqrt{\frac{2}{f A_z}} \left(\cos \left(\frac{\pi}{4} - \alpha \right) (\sinh az \cdot \cos (az + 2aH)) + \right. \\ &\quad \left. + \cos az \cdot \sinh a(z + 2H) \right) - \sin \left(\frac{\pi}{4} - \alpha \right) (\sin (az + 2aH) \cdot \cosh az + \\ &\quad \left. + \sin az \cdot \cosh (az + 2aH) \right) \end{aligned} \quad (3.1)$$

$$\begin{aligned} v_E &= \frac{\tau}{\rho_w (\cos 2aH + \cosh 2aH)} \sqrt{\frac{2}{f A_z}} \left(\cos \left(\frac{\pi}{4} - \alpha \right) (\sin az \cdot \cosh (az + 2aH)) + \right. \\ &\quad \left. + \cosh az \cdot \sin a(z + 2H) \right) - \sin \left(\frac{\pi}{4} - \alpha \right) (\sinh (az + 2aH) \cdot \cos az + \\ &\quad \left. + \sinh az \cdot \cos (az + 2aH) \right) \end{aligned} \quad (3.2)$$

with $a = \sqrt{\frac{f}{2A_z}}$.

3. The Ekman currents water transport

For the complete study of the waters dynamics it is necessary to calculate the water transport. It is known that the wind-driven Ekman current has its maximum velocity at the surface and its minimum at the bottom, because the speed decreases with depth increase. The strongest currents are to the right on the wind direction in the north hemisphere and the Ekman transport too. It is important to calculate the angle between the Ekman transport and the wind direction. The basic form of the equations for horizontal motion in the absence of any pressure gradient is used for this:

$$\begin{aligned} 0 &= \rho_w f v_E + \frac{\partial \tau_x}{\partial z} \\ 0 &= -\rho_w f u_E + \frac{\partial \tau_y}{\partial z} \end{aligned}$$

which can be write as [8]

$$\begin{aligned} \rho_w f v_E dz &= -d\tau_x \\ -\rho_w f u_E dz &= -d\tau_y \end{aligned}$$

The expression $\rho_w f v_E dz$ gives the mass flowing per second in the y -direction through a vertical area of depth dz and width one metre in the x -direction, and $\int_z^0 \rho_w f v_E dz$ will be the total mass flowing in the y -direction from the level z to the surface for this strip 1 m wide, while $\int_z^0 \rho_w f u_E dz$ will be the total mass transport per unit width in the x -direction. If we choose

the lower level deep enough, then the integrals will include the whole wind-driven current. It is used the symbol M_{xE} for the Ekman mass transport in the x -direction and M_{yE} in the y -direction. It can be written

$$f M_{yE} = f \int_{-H}^0 \rho v_E dz \quad \text{and} \quad f M_{xE} = f \int_{-H}^0 \rho u_E dz.$$

Using (3.1)-(3.2) formulas, and the calculus

$$\Phi = \int_{-H}^0 (u_E + iv_E) dz = \int_{-H}^0 w_E dz,$$

with

$$w = \frac{\tau}{\rho_w (\cos 2aH + \cosh 2aH)} \sqrt{\frac{2}{f A_z}} [(e^{2aH} + e^{2aHi}) e^{(1+i)az} - (e^{-2aH} + e^{-2aHi}) e^{-(1+i)az}]$$

the expression for the volume Ekman currents transport (per unit width) is:

$$\Phi = \frac{\tau (\cos \alpha - i \sin \alpha)}{2 f \rho_w (\cosh 2aH + \cos 2aH)} [\cosh 2aH + \cos 2aH - 2 \cos aH \cdot \cosh aH + 2i \sin aH \cdot \sinh aH] \quad (4)$$

The two components of the water transport are:

$$\Phi_x = \frac{\tau}{2 f \rho_w} \left(1 - 2 \frac{\cos aH \cdot \cosh aH}{\cosh 2aH + \cos 2aH} \right) \cos \alpha + 2 \frac{\tau}{2 f \rho_w} \frac{\sin aH \cdot \sinh aH}{\cosh 2aH + \cos 2aH} \sin \alpha \quad (5.1)$$

and

$$\Phi_y = 2 \frac{\tau}{2 f \rho_w} \frac{\sin aH \cdot \sinh aH}{\cosh 2aH + \cos 2aH} \cos \alpha - \frac{\tau}{2 f \rho_w} \left(1 - 2 \frac{\cos aH \cdot \cosh aH}{\cosh 2aH + \cos 2aH} \right) \sin \alpha \quad (5.2)$$

The Ekman transport magnitude is:

$$|\Phi| = \frac{\tau}{2 f \rho_w} \frac{\cosh \left(\sqrt{\frac{f}{2A_z}} H \right) - \cos \left(\sqrt{\frac{f}{2A_z}} H \right)}{\sqrt{\cos^2 \left(\sqrt{\frac{f}{2A_z}} H \right) + \sinh^2 \left(\sqrt{\frac{f}{2A_z}} H \right)}} \quad (6)$$

a. The Ekman currents water transport for the Romanian Black Sea shore

For the Romanian Black Sea shore the latitude can be approximate with 45° and then the Coriolis coefficient can be estimate with the value $f = 10^{-4} \text{ s}^{-1}$. The wind stress magnitude can be expressed $\tau = \rho_{air} C_D W^2$, where C_D is the drag coefficient $C_D \approx 1.4 \times 10^{-3}$ and W is the wind speed (in m/s) and $\rho_{air} = 1.3 \text{ m}^3/s$, $\rho_w = 1025 \text{ kg/m}^3$. The volume transport of Ekman currents magnitude becomes:

$$|\Phi| = 0.0088 W^2 \frac{\cosh \left(0.007 \frac{H}{\sqrt{A_z}} \right) - \cos \left(0.007 \frac{H}{\sqrt{A_z}} \right)}{\sqrt{\cos^2 \left(0.007 \frac{H}{\sqrt{A_z}} \right) + \sinh^2 \left(0.007 \frac{H}{\sqrt{A_z}} \right)}} \quad (7)$$

On the Romanian Black Sea shore the water circulation is determined by wind and geostrophic processes [11]. The littoral masses between -40/-45 and -10 m, support a great influence from specific friction processes driven by the wind, with a great spacial and temporal variability. The north and northwest winds determine a general circulation to north-south direction with 0.3 to 3.6 cm/s, with a water discharge between 5750 m^3/s and 77559 m^3/s . This southern circulation alternates with a northern one, determined by the south winds. Currents with 0.1-2.9 cm/s appear with 2687-61586 m^3/s a water transport.

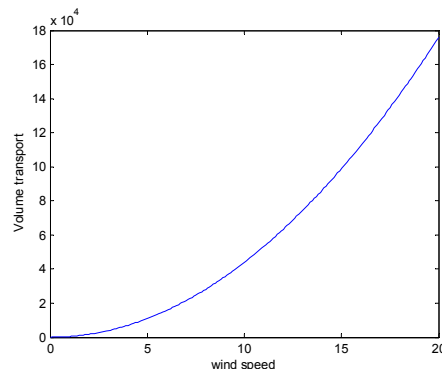


Fig. 1. The volume water transport variation depending on the wind speed. The speed in m/s, and the volume transport in m^3/s

Relatively little is known on the role of fresh water runoff from major rivers in establishing a density driven component of the circulation. Although their effects are suspected to be of secondary importance, both the river inflows and the Bosphorus fluxes are expected to modify the circulation through local effects superimposed on the horizontal and vertical ambient stratification. The northwestern shelf and the Bosphorus vicinity are the two important areas where lateral sources and convection modify the Black Sea circulation [12]. The competing effects of freshwater inflow and winter cooling respectively create and destroy vorticity in the first area, while intermediate depth intrusions driven by shelf mixing of the dense Mediterranean inflow [13] create disturbances including vertical motions in the second area in both regions, the eddy kinetic energy increases at the expense of mean kinetic energy.

4. Conclusions

The Ekman theory is very useful for the marine currents study. The water transport calculus allows to study many others properties of water circulation. It is very difficult to compare the results obtained by calculi and the real ones. We assumed that, in the water transport, there is a very important role of fresh water runoff from major rivers, from geostrophic processes, from specific friction processes driven by the wind, with a great spacial and temporal variability.

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A MATHEMATICAL METHOD TO DETERMINE THE ENERGY CONSUMPTION AND POLLUTANT EMISSIONS FROM MARITIME TRANSPORT

Florin NICOLAE¹
Adriana MUNTEANU

¹ „Mircea cel Batran” Naval Academy, Constantza, Romania

Abstract: In EU member countries, in 2008, transport was responsible for almost a third of final energy consumption and for more than a fifth of greenhouse gas emissions. Although there are some data bases that can be used for assessing the amount of pollutant emissions from maritime transport, it is important to be aware that assessing the amount of emissions from an array of mobile sources (such as vessels or other means of transport) is more difficult than assessing the amount of emissions from a limited number of stationary sources (such as plants or thermal power stations). Many assessments should be based on intergradations and mathematical methods; the latter is being used for rating the volume of pollutant emissions commensurate with all types of scenario that can occur in a certain amount of time and in one area.

Keywords: air pollutant emissions, greenhouse effect, maritime transport

1. Introduction

The main task of this work has regarded the definition of the structure of the data for maritime traffic.

The final structure of data has been determined through the definition of a simplified methodology and a complete methodology; the first one is used for an estimate that doesn't take into account port loading and unloading and auxiliary power generator; the complete one is used for the estimate of emissions from ships in cruise and on port.

The first stage consists in collecting the existing documentation and information regarding the energy consumption and emission factors. The second stage has regarded the analysis of the documentation in order to produce a methodology of estimating air pollutant emissions from ships, taking into account all the available information. From a consumption and emissions point of view, there are two maneuvering phases: the standing phase, the cruising phase.

After its arrival in harbour, a vessel continues to emit pollutant gases at dockside in the standing phase. Power must be generated in order to supply the ship's lighting, heating, refrigeration, ventilation, etc. A few steam ships use auxiliary diesel engines to supply power, but they generally operate one or more main boilers under reduced load. Ships powered by internal combustion engines normally use diesel powered generators to furnish auxiliary power. For liquid bulk ships must be also take into account power requirements of the cargo pumps for tanker offloading and of the ballast pumps for tanker loading. In smaller tankers the pumping power requirement will add to the electrical load whereas for larger tanks steam turbine driven pumps are generally used (even on motor tankers) with a consequent boiler load. As these power requirements can be relatively high the emissions will be separately estimated. In ferry traffic the standing and maneuvering phases are not as essential as the cruising phase. It could be essential to take into account maneuvering for short passages; as the passage length increases (i.e. over a few hours) this element will reduce and under those circumstances could be neglected.

2. The simplified methodology for estimating emissions from ships

For the application of the simplified methodology are needed an estimate the following: number of working days for each class of ship; engines type; type of fuel used by every type of vessel.

The emissions are obtained as:

$$E_i = \sum_{jkl} E_{ijkl} \quad (1)$$

with:

$$E_{ijkl} = S_{jk}(GT) \cdot t_{jkl} \cdot F_{ijl} \quad (2)$$

where: i - pollutant (see table 1); j - fuel (see table 2); k - ship class for use in consumption classification (see table 3); l - engines type class for use in emission factors characterization (see table 4); E_i - total emissions of pollutant i; E_{ijkl} - total emissions of pollutant i from use of fuel j on ship class k with engines type l;

$S_{jk}(GT)$ - daily consumption of fuel j in ship class k as a function of gross tonnage; t_{jkl} - days in navigation of ships of class k with engines type l using fuel j; F_{ijl} - average emission factors of pollutant i from fuel j in engines type l (for SO_x , taking into account average sulfur content of fuel).

Table 1. Pollutants classification

| NAME | CODE |
|----------------------------|-----------------|
| Nitrogen oxides | NO _x |
| Sulfur oxides | SO _x |
| Carbon monoxide | CO |
| Volatile Organic Compounds | VOC |
| Particulate matter | PM |
| Carbon dioxide | CO ₂ |

Table 2. Fuel classification

| NAME | CODE |
|-------------------|------|
| Bunker fuel oil | BFO |
| Marine diesel oil | MDO |
| Marine gas oil | MGO |
| Gasoline oil | GF |

Table 3. Ship type class

| NAME | CODE |
|-------------------------|------|
| Solid bulk | SB |
| Liquid bulk | LB |
| General cargo | GC |
| Container | CO |
| Passenger/ RO-RO/ Cargo | PC |
| Passenger | PA |
| High speed ferries | HS |
| Inland cargo | IC |
| Sail ship | SS |
| Tugs | TU |
| Fishing | FI |
| Other | OT |

Table 4. Engines type class

| NAME | CODE |
|----------------------------------|------|
| Steam turbines | SE |
| High speed motor engines | HS |
| Medium speed motor engines | MS |
| Slow speed motor engines | SS |
| Inboard engines - pleasure craft | IP |
| Outboard engines | OP |
| Tanker loading and offloading | TO |

3. Emission factors data review

The first data annex contains a complete review of all the emission factors available in literature is reported. In the second data annex are reported the average emissions factors for diesel-powered electrical generators in vessels. These factors can be used for estimating emissions of auxiliary diesel generators for standing phase. In table 5 are reported the default emission factors proposed for using in simplified methodology.

Table 5. Proposed emission factors (kg/ton of fuel) for using in the simplified methodology

| Engine types | NO _x | CO | CO ₂ | VOC | PM | SO _x |
|------------------------------|-----------------|-------|-----------------|-------|------|-----------------|
| Steam turbines – BFO engines | 6,98 | 0,431 | 3200 | 0,085 | 2,50 | 20S |
| Steam turbines – MDO engines | 6,25 | 0,6 | 3200 | 0,5 | 2,08 | 20S |
| High speed diesel engines | 70 | 9 | 3200 | 3 | 1,5 | 20S |
| Medium speed diesel engines | 57 | 7,4 | 3200 | 2,4 | 1,2 | 20S |
| Slow speed diesel engines | 87 | 7,4 | 3200 | 2,4 | 1,2 | 20S |
| Gas turbines (*) | 16 | 0,5 | 3200 | 0,2 | 1,1 | 20S |

(*) evaluated on the basis of available information on land-based installation. For NO_x the emission factor is 14-19 kg/ton for marine engine (Sowman, 2005) and 16 kg/ton for land-based gas turbines (EMEP Task Force on Emission Inventories, 2005). For the other pollutants the emission factors are for land-based gas turbines (EMEP Task Force on Emission Inventories, 2005 for CO and VOC, and EPA, 2005 for PM).

4. Fuel consumption data review

In the following pages are presented the elaboration of fuel consumption data at full power. Particularly, regression analyses on fuel consumption vs. gross tonnage are performed for each ship class except inland navigation (for which data on general cargo must be used). The data are highly correlated ($r > 0.68$ for all cases) and all the regressions are significant on a confidence level greater than 99%. In the table 6 are reported the derived functions used for calculating fuel consumption reported to gross tonnage (where C_{jk} is for consumption of fuel j in ship class k in t/day and GT is for gross tonnage). When no information about ship class is available can be used fuel consumption regression data for all ships in database. In this case the

results for all ships in table 6 can be used. If no information on gross tonnage is available, the average consumption of table 6 can be used. The effective fuel consumption can be obtained, in simplified methodology as:

$$S_{jk}(GT) = C_{jk}(GT) \cdot 0,8 \quad (3)$$

where: $S_{jk}(GT)$ - daily consumption of fuel j in ship class k as a function of gross tonnage; $C_{jk}(GT)$ - daily consumption at full power of fuel j in ship class k as a function of gross tonnage. In the following page is presented a sighting line that can be used very rapidly to settle fuel consumption reported to gross tonnage for a liquid bulk cargo (Figure 1) and for a general cargo vessel (Figure 2).

Table 6. Average consumption at full power and linear regression equations of consumption at full power versus gross tonnage

| Ship types | Average consumption (t/day) | Consumption at full power (t/day) as function of gross tonnage (GT)* |
|-------------------------------|-----------------------------|--|
| Solid bulk | 33,8 | $C_{jk} = 20,189 + 0,00049 \cdot GT$ |
| Liquid bulk | 41,15 | $C_{jk} = 14,685 + 0,00079 \cdot GT$ |
| Cargo | 21,27 | $C_{jk} = 9,8197 + 0,00143 \cdot GT$ |
| Container | 65,88 | $C_{jk} = 8,0552 + 0,00235 \cdot GT$ |
| Passenger/Ro-Ro/General cargo | 32,28 | $C_{jk} = 12,834 + 0,00156 \cdot GT$ |
| Passenger | 70,32 | $C_{jk} = 16,904 + 0,00198 \cdot GT$ |
| High speed ferry | 80,42 | $C_{jk} = 39,483 + 0,00972 \cdot GT$ |
| Inland cargo | 21,27 | $C_{jk} = 9,8197 + 0,00143 \cdot GT$ |
| Sail ships | 3,38 | $C_{jk} = 0,42682 + 0,001 \cdot GT$ |
| Tugs | 14,35 | $C_{jk} = 5,6511 + 0,01048 \cdot GT$ |
| Smack | 5,51 | $C_{jk} = 1,9387 + 0,00448 \cdot GT$ |
| Other ships | 26,40 | $C_{jk} = 9,7126 + 0,00091 \cdot GT$ |
| All Ships | 32,78 | $C_{jk} = 16,263 + 0,0001 \cdot GT$ |

(*) j - fuel; k - ship class

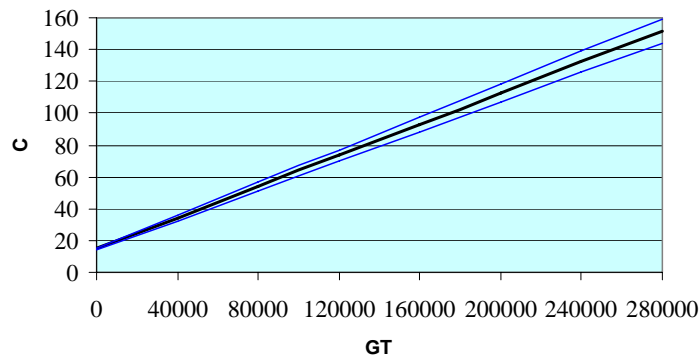


Fig. 1 Fuel consumption (in t/day) vs. gross tonnage – Liquid bulk

$$C = 14,685 + 0,00079 \cdot GT \quad (4)$$

$$C = f(GT)$$

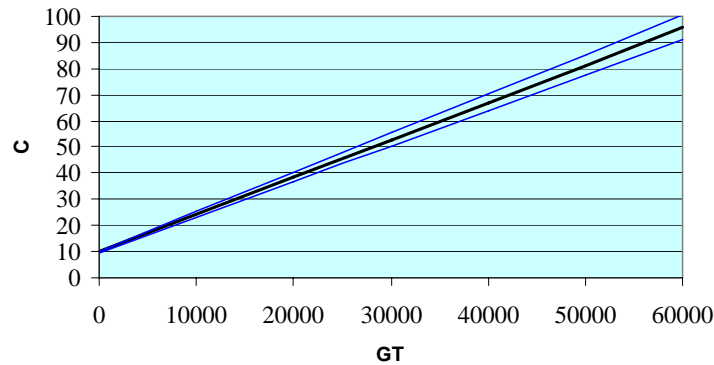


Fig. 2 Fuel consumption (in t/day) vs. gross tonnage – General cargo

$$C = 9,8197 + 0,00143 \cdot GT \quad (5)$$

$$C = f(GT)$$

5. Days in navigation as function of average cruise speed for using in simplified and detailed methodologies

If days in navigation are not known, they can be estimate from service speed and distance covered as:

$$t = \frac{d}{v} \quad (6)$$

where: t - days in navigation; d - distance covered (nautical miles); v - average service speed in knots (nautical miles/h) for ship type. In table 7 are reported the average service speeds for ship classes, and they can be used for any vessel type.

Table 7. Average speed (knots) for ship type

| Ship type | Average speed (knots) |
|-----------------------|-----------------------|
| Solid bulk | 14.32 |
| Liquid bulk | 14.20 |
| General cargo | 14.29 |
| Container | 19.09 |
| Passenger/Ro-Ro/Cargo | 16.49 |
| Passenger | 17.81 |
| High speed ferry | 36.64 |
| Inland cargo | 14.29 |
| Sail ships | 9.63 |
| Tugs | 12.91 |
| Smacks | 11.96 |
| Other ships | 13.45 |
| All ships | 14.77 |

6. Example of application of the simplified methodology

In the following lines is presented an example of elaboration. We take into account the following ships:

| Number an type of ships | Gross tonnage | Nautical miles | Engine |
|-------------------------|---------------|----------------|---------------------|
| 2 Ro-Ro | 3000 | 3000 | Medium speed diesel |
| 1 Cargo | 8000 | 3000 | Medium speed diesel |

We obtain for NO_x emissions:

$$E_{NO_x} = \left[C(GT) \cdot \frac{d}{v} \cdot F_{ijklm} \right] \cdot \text{number of vessels} \quad (7)$$

$$E_{NO_x} = [(12,834 + 0,00156 \cdot 3000) \cdot 0,8 \cdot 3000 / 16,49 \cdot 2 + (12,834 + 0,00156 \cdot 8000) \cdot 0,8 \cdot 3000 / 16,49] / 1000 \cdot 57 = 501 \text{ t}$$

7. Conclusions

There are two methodologies used for estimating the amount of emissions resulted from ships: the simplified methodology and the detailed methodology.

The main difference between those two is that the latter takes into account the following: the emissions resulted in cruising phase; the emissions resulted in standing phase; the emissions produced by the auxiliary generators; the emissions produced by the pumps used for offloading and for the ballast pumps for tanker loading; the emissions produced by the engines of the pleasure boats. By using the tables and the mathematical methods, can be assessed the amount of one particular type of pollutant produced by one particular vessel type depending of its gross tonnage and other parameters, and together can give an result almost exact. By assessing the amount of emissions by ship characteristics it is possible to create a data base that can be used for creating software that can establish the maximum level of contamination in costal areas (sea ports are very exposed to air pollutant emissions from ships) and in open seas.

The approach of composition of the mathematical method and the input data can be used to determine the amount of pollutant emissions conformable to any scenario unwounded in a certain amount of time and in any area. The results obtained can be used to establish the future strategies of development of maritime transport by the durable principles promoted by the European Maritime Policy.

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NOISE AND VIBRATIONS PRODUCED ONBOARD FRIGATES TYPE 22

Tiberiu PAZARA¹
Silvestru GROZEANU²

¹ PhD candidate teacher assistant, Naval Academy „Mircea cel Batran“, Constanta

² PhD lecturer, Naval Academy „Mircea cel Batran“, Constanta

Abstract: *The noise produced onboard military ships affects the efficiency and comfort of crew, and the vibrations produced affects the working state of the equipment. Yet, both noise and vibrations affects ship's safety, making it easier to be detected by the enemy. The paper considers some aspects of noise and vibration and their sources onboard frigates.*

Key words: *noise, vibration, frigates.*

1. Introduction

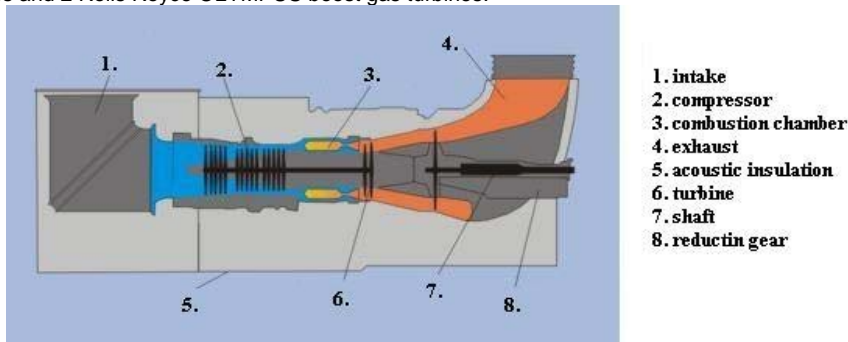
Frigates Type 22 were first launched in 1979 and they were build so they can be continuously upgraded. The Type 22 was designed to be a specialist anti-submarine warfare vessel. The following navies use this type of frigate: Royal Navy, Brazilian Navy, Romanian Naval Forces and Chilean Navy. The ones in service of Romanian Naval Forces were purchased by the Romanian Government in 2003 and 2005. After a period of inspections, repairs and upgrades the frigates began their missions. Because of the complexity of their missions, the status of the equipment onboard must be verified periodically to ensure its optimum performance. Plus, the safety and the comfort of the crew are considered. The safety of the ship and also the safety of the crew depend on ship's acoustic signature which must be discreet so that it cannot be detected by the enemy.

2. Noise and vibration sources

There are a number of sources of noise and vibration present in a ship. Typically, these may include:

- diesel engines
- gas turbines
- shaft-line dynamics
- reduction gear
- auxiliary pumps
- air conditioning systems
- compressors
- intakes and exhausts

These sources are also present aboard a frigate. The propulsion of Type 22 frigate consists of a combination of OLYMPUS and TYNE gas turbines in a COGOG (COmbined Gas turbine Or Gas turbine) arrangement: 2 Rolls Royce TYNE cruise gas turbines and 2 Rolls Royce OLYMPUS boost gas turbines.



Rolls Royce OLYMPUS turbine

3. Methods of measurement and results

The ship was anchored, so that the weather conditions didn't influence the measurements. Therefore we can assume that the measurement conditions were normal conditions of pressure and temperature, and the sea was calm. And so, the ambient noise level was low.

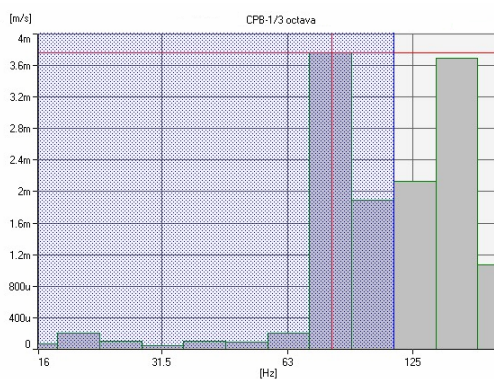
The measurement equipment comprises a 5 channel PULSE system from Bruel&Kjaer, with triaxial transducers (type DeltaTron 4506) and an omnidirectional microphone.



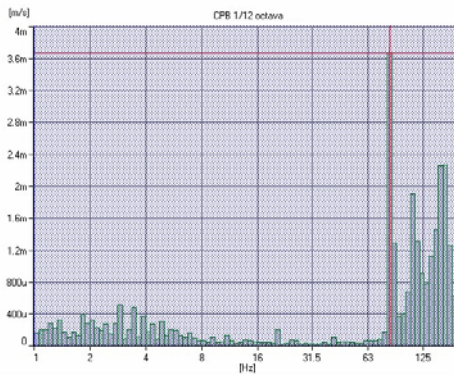
This kind of vessel relies on its propulsion system. The TYNE turbines are used for cruising speeds, while OLYMPUS turbines are used for boost speed (when it is chasing the enemy). Because the ship's propulsion system is very important, the measurements took place only in the machinery compartments.

The measurements were conducted according to ISO A.468 (Code on noise levels on board ships). Because the TYNE turbines are used for long periods of time, the level of vibrations was measured. Since the OLYMPUS turbines generate a large amount of noise when they are used, then the level of noise was measured. The transducers were placed on turbine's case in blades section. The microphone was placed in the middle of the compartment at a distance approximately 1.5m and at 1.4m above the ground. The signals were transferred into a laptop included in PULSE system through an acquisition board and they were recorded for further analysis. The signals were processed using the software PULSE 12 and analyzed in different frequency bands.

For vibrations, it was used the Constant Percentage Bandwidth (CPB) measurement. The CPB measurement has been developed specifically to provide early detection for the most common machine faults with minimal risk of false alarms. This is made possible by an ingenious filtering algorithm that provides sufficient resolution for reliably detecting the most common types of faults. The CPB is based on a constant relative bandwidth on a logarithmic scale - i.e. the bandwidth of each spectrum bar is a fixed percentage of the centre frequency. This means the frequency resolution is relatively high at the lower frequencies and coarser at the higher frequencies, which is ideal for reliable, early fault detection. The results were plotted as velocity vs. frequency.



Tyne CPB 1/3 octave



Tyne CPB 1/12 octave

The noise measurements were analyzed using the Autospectral Density Function. The autospectral density function (also called the power spectral density function, or simply the autospectrum or power spectrum) is a frequency-domain function that defines the spectral content of a stationary random signal $x(t)$. It is given by:

$$G_{xx}(f) = \lim_{T \rightarrow \infty} \frac{2}{T} E \left[|X_T(f)|^2 \right], \quad f > 0 \quad (1)$$

where $|X_T(f)|$ is the magnitude of the Fourier transform of $x(t)$ over the time interval T and $E[\]$ denotes the expected value operator, which implies an averaging operation.

Because many real signals aren't periodic signals, it is used the next set of Fourier transforms:

$$X(\omega) = \int_{-\infty}^{+\infty} x(t)e^{-j\omega t} dt; \quad x(t) = \frac{1}{2\pi} \int_{-\infty}^{+\infty} X(\omega)e^{j\omega t} d\omega \quad (2)$$

The two Fourier integrals are equivalent from information point of view, offering data in time domain or in frequency domain.

One can write:

– the direct Fourier transform:

$$S_{xx}(\omega) = \int_{-\infty}^{+\infty} R_{xx}(\tau) e^{-j\omega\tau} d\tau = F^{-1}\{R_{xx}(\tau)\} \quad (3)$$

– the inverse Fourier transform:

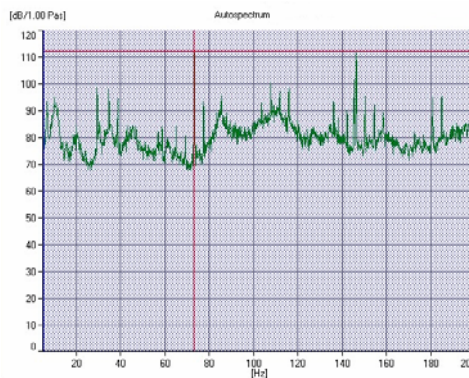
$$R_{xx} = \frac{1}{2\pi} \int_{-\infty}^{+\infty} S_{xx}(\omega) e^{j\omega\tau} d\omega = F^{-1}\{S_{xx}(\omega)\} \quad (4)$$

The quantity $S_{xx}(\omega)$ is the power autospectral density function or power autospectral density, simply *autospectrum*.

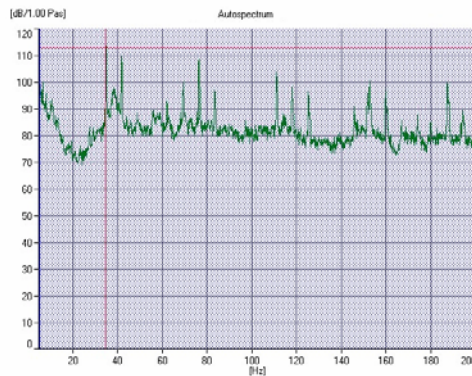
So one can write:

$$\frac{1}{T} \int_0^T x^2 dt = \int_{-\infty}^{+\infty} S_{xx}(f) df = 2 \int_0^{\infty} S_{xx}(f) df = \int_0^{\infty} G_{xx}(f) df = x_{rms}^2 \quad (5)$$

where $G_{xx}(f) = 2 S_{xx}(f)$ is the one-dimensional autospectral density. This function is defined only for positive frequencies as it is used in the technique of digital or analogical measurement of stationary processes.



Olympus larboard



Olympus starboard

4. Conclusions

After a prolong service, frigate's machinery that was investigated during these tests present no major dysfunctions. The variation of TYNE vibration does not exceed the limits provided by the manufacturer – 4mm/s. Those variations are caused by the extensive use because TYNE turbines function over a long period of time. The OLYMPUS turbines exceed very little the limits approved by international standards – 110dB and since that compartment isn't continuously supervised, it does not represent a major hazard for the personnel working in that area. As standards recommend, the personnel working in compartments like this must wear protection gear (i.e. headsets).

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THEORETICAL CONSIDERATIONS ABOUT THE INFLUENCE OF THE NAVAL BULB’S PLATE THICKNESS OVER THE EXTREME VALUES OF THE MAXIMUM PRINCIPAL STRESS WHICH OCCUR IN IT DURING THE HYDRODYNAMIC IMPACT

Adrian POPA¹

¹ Lt. (Navy) Lecturer eng., Naval Academy „Mircea cel Bătrân”, Constanța

Abstract: During the navigation in rough sea, the bow of the ship gets off the water and at the entrance suffers a hydrodynamic impact. The structural response of the ship it's a very destructive one. That way, the designers has tried to reinforce the bow structure at the most load point. In this paper, the author makes a short theoretical analysis about the influence of the plate thickness over the extreme values of the principal stress.

Keywords: slamming, hydrodynamic impact, structural optimization

A very good estimation of the forces acting on the bulbous bow during the hydrodynamic impact can be made using the added mass coefficient obtained by Katzuji Tanizawa.

The situation is the following:

Am semielliptical body is following into a fluid like in figure 1

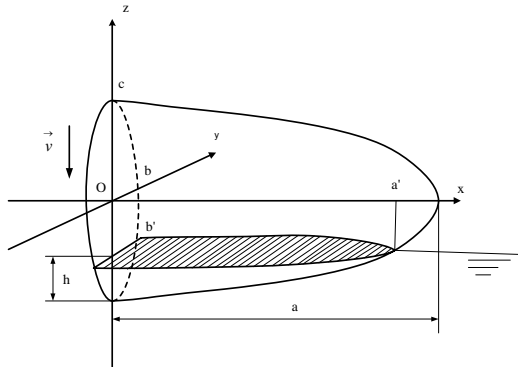


Figure 1. The semielliptical body diving into a fluid

The equation of the elliptical surface, defined by the intersection between the body and fluid (the hatched surface in the figure) is:

$$\left(\frac{x}{a}\right)^2 + \left(\frac{y}{b}\right)^2 + \left(\frac{z}{c}\right)^2 = 1 \quad (1)$$

The origin of time, $t=0$ is the moment when the body touches the water.

At one moment, t , the depth is $h = v \cdot t$, where v is the initial speed of the body. At the time t , intersection between the body and the water surface is also semielliptical. The axes are:

$$a' = a\sqrt{\zeta(t)}, \quad b' = b\sqrt{\zeta(t)} \quad (2)$$

Where

$$\zeta(t) = \frac{2v}{c} \cdot t - \left(\frac{v}{c}\right)^2 t^2 \quad (3)$$

The added mass is:

$$m_a = \frac{1}{2} \rho \pi a' b'^2 f_0(s) = \frac{1}{3} \rho \pi a b^2 \zeta(t)^{\frac{3}{2}} f_0(s) \quad (4)$$

ρ is the density and $f_0(s)$ is the added mass coefficient.

According to Taniyawa, $f_0(s)$ is:

$$f_0(s) = 1 - 0,094 \cdot s - 0,9140 \cdot s^2 + 0,9749 \cdot s^3 - 0,3302 \cdot s^4 \quad (5)$$

The analysed body have the lenght $L=40\text{cm}$, diameter $D=20\text{cm}$ and different plate thickness. Discretisation of the body is show in figure 2.

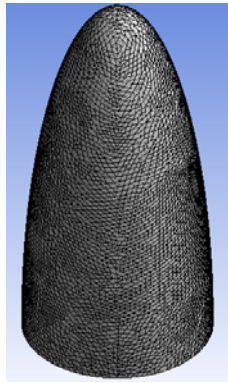


Figure 2 Discretisation of the semi elliptical body.

The body has been considered to be rigid into his base and the force equally distributed over the wet surface. The surface is considered to be the wetted surface of the body when the force reaches its maximum. The variation of the added mass is shown in figure 3.

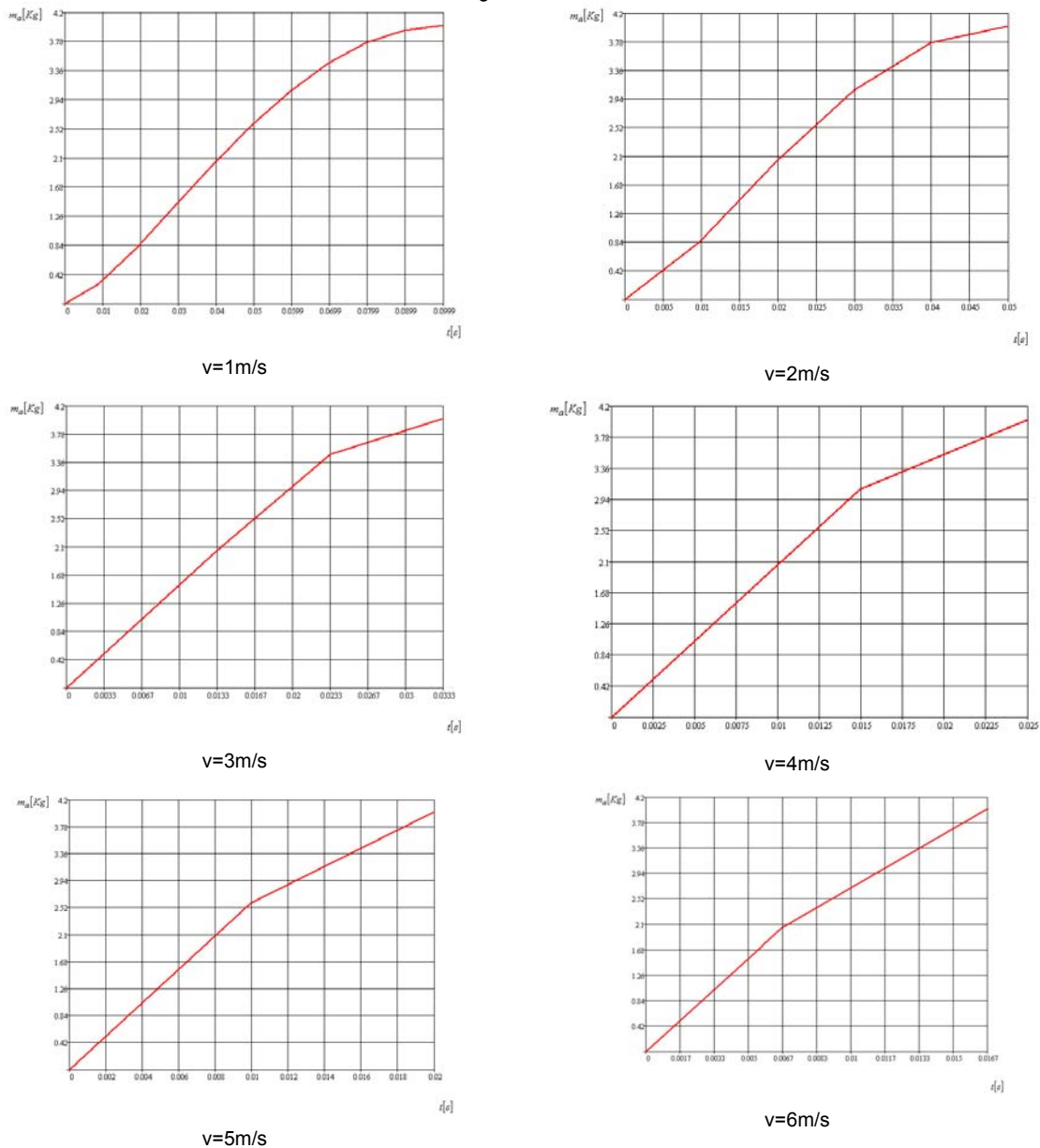
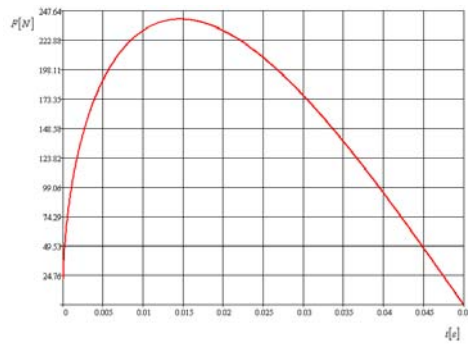


Figure 3 Variation of the added mass for different values of the initial impact speed.

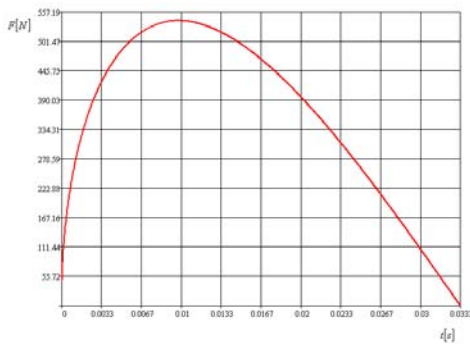
The variation of the maximum force is shown in figure 4



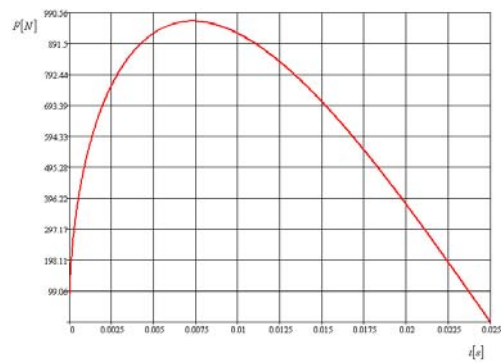
$v=1\text{m/s}$



$v=2\text{m/s}$



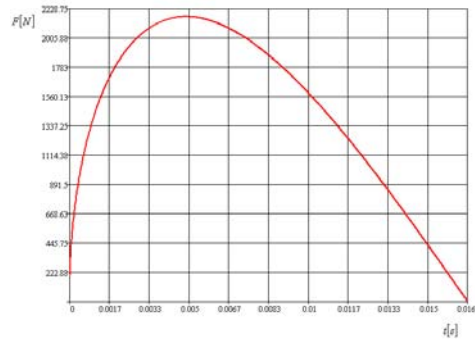
$v=3\text{m/s}$



$v=4\text{m/s}$



$v=5\text{m/s}$

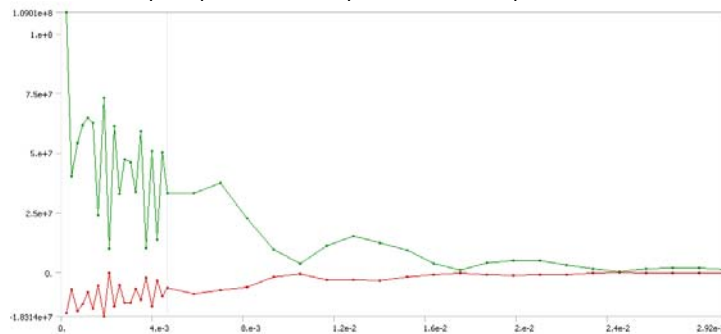


$v=6\text{m/s}$

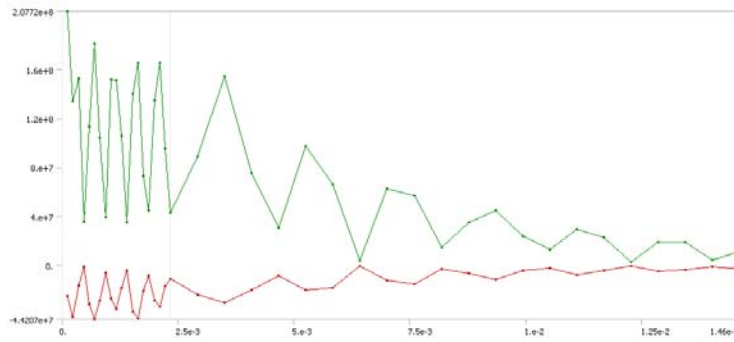
Figure 4 Variation of the maximum force for different values of the initial impact speed.

The variation of the extreme values of the principal forces for a plate thickness equal with 6mm is shown in figure 5.

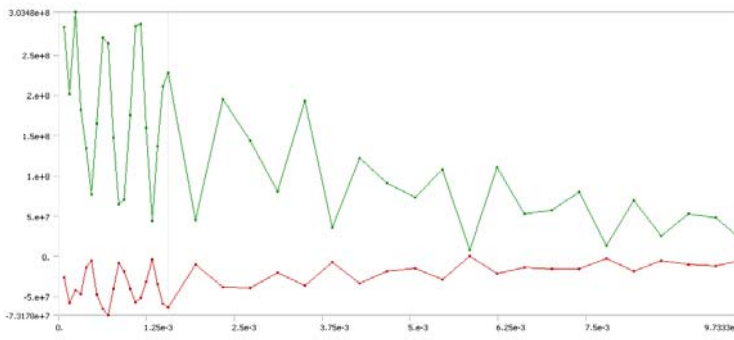
$$\left[\frac{N}{m^2} \right]$$



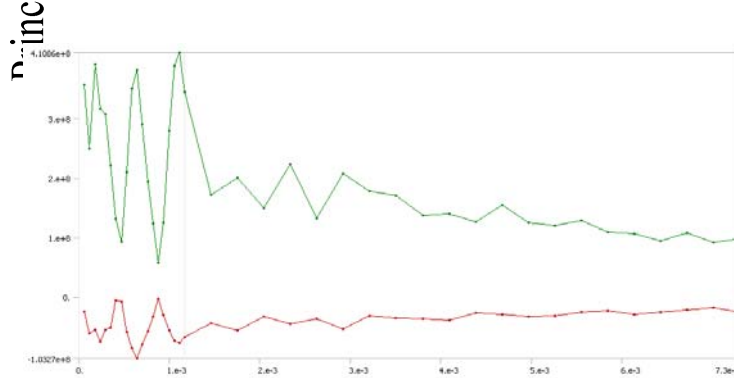
$\left[\frac{N}{m^2} \right]$ $v=1m/s$ Time [s]



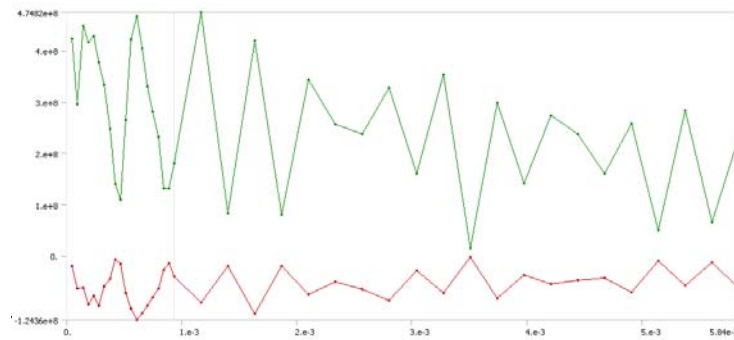
$\left[\frac{N}{m^2} \right]$ $v=2m/s$ Time [s]



$\left[\frac{N}{m^2} \right]$ $v=3m/s$ Time [s]



$\left[\frac{N}{m^2} \right]$ $v=4m/s$ Time [s]



Principal st

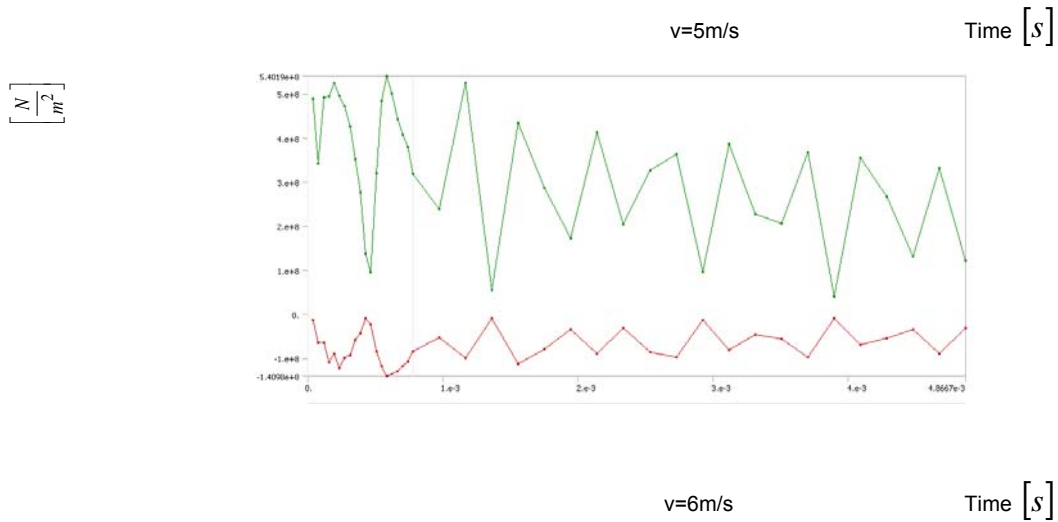


Figura 5 Variation of the principal stress for the plate thickness equal with 6mm, for different values of the impact speed.

The final results are presented in figure 6.

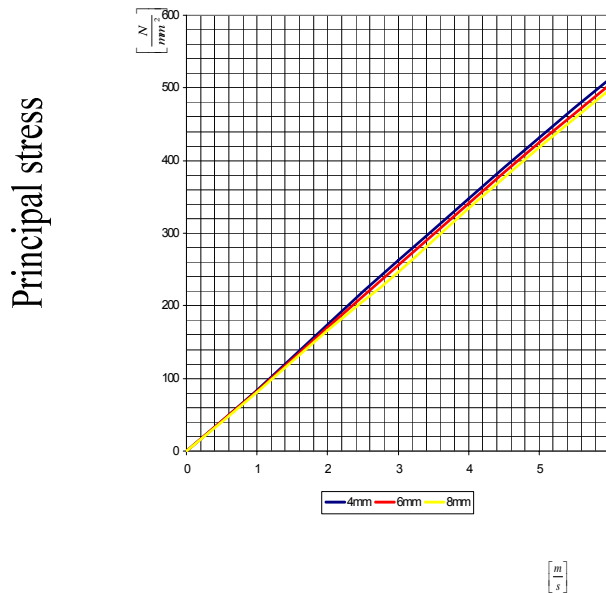


Figure 6 Variation of the extreme value of the maximum stress vor different plate thickness, and different impact speeds.

Conclusions:

As it's shown in figure the values of the extreme principal stress are decreasing while the plate thickness is increasing (as it should be). Also, from the diagram in the figure 6, we can see the phenomena can be aproximated to be quasy liniar for this tipe of bulb (having the ratio L/D equal with 2).

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PLACES TO IDENTIFICATION NARROW MONTAJ OF AUTOMATED DEVICES FOR IGNITION BY ELECTRICAL SIMULATION OF WINQSB

Gheorghe POPESCU¹

Ștefan GHIMIȘI²

Alin STĂNCIOIU³

¹ Prof. Dr. Eng.- “C. Brâncuși” University of Târgu Jiu

² Prof. Dr. Eng.- “C. Brâncuși” University of Târgu Jiu;

³ Lecturer. Dr. Eng.- “C. Brâncuși” University of Târgu Jiu

Abstract: *In this work the authors present the result of the theoretical researches and experiences concerning the identification and elimination of the tight places in the automatic montage of the electric ignition devices used in the pyrotechnic industry for improving the labour productivity.*

Taking into account the fact the above production system is an expectation system depending on a theoretical study followed by computer simulation with the data processing product WINQSB, Queing System Simulation module, we identified the tight places that generate expectation queues when remaking, verifying and assembling the electric ignition devices of the indigenous electric detonators.

In this way, using the WINQSB simulation, we offered solutions for 3 analysis types :

the ensemble and marks analysis which entered the system, the analysis of the working machines using and the analysis of the queues.

Keywords: *Electropirotehnics inflammatory, programming language, processing component, during the assembly, tight spots, queues, simulation, clients, analysis of clients, analysis of queues.*

1 Introduction

The electric ignition of the electric detonator consists of indigenous electropirotehnics inflammatory and conductors connecting reofori appointed, assembled between them by soldering, by welding or by cold plastic deformation (Figure 1). Also to be assembled with the capsule has a cork bung PVC injected directly conductors connecting. The electric ignition of the electric detonator consists of indigenous electropirotehnics inflammatory and conductors connecting appointed, assembled between them by soldering, by welding or by cold plastic deformation (Figure 1). Also to be assembled with the capsule has a cork bung PVC injected directly conductors connecting.



Figure 1. The electric ignition.

2 Proposed simulation model

Figure 2 shows the layout of processing workshop, ohmic resistance to control inflammation, and injection plug assembly on reofori obturator composed of seven cars. In this workshop are processed and assembled two components: X - reoforii and Y - electropirotehnics inflammatory

Before being assembled on the machine 4, the components of X are subject to buclare operations on the machine 1 and ends on desizolare machine 2, and Y-type components are subjected to operations for deployment of the first blades from the leading card and control resistant ohmică the machine 3. After assembling the machine components of a 4 X with a Y to obtain a new piece which is subject to settlement operations of the devices injected into the machine 5, the obturator injecatare plug on the machine 6 and disengagement of the injection device on the machine 7. If one machine is busy or when the parts must wait to be processed intermediate form between stocks of different processing. In this production system, the X, Y components and parts through assembly results represent clients requesting service stations and cars are serving.

Information Base. For assembling electric ignition device we used programming language WINQSB. For the X and Y, we determined the probability distributions of time between two consecutive arrivals.

Analyzing data from earlier periods were established as follows:

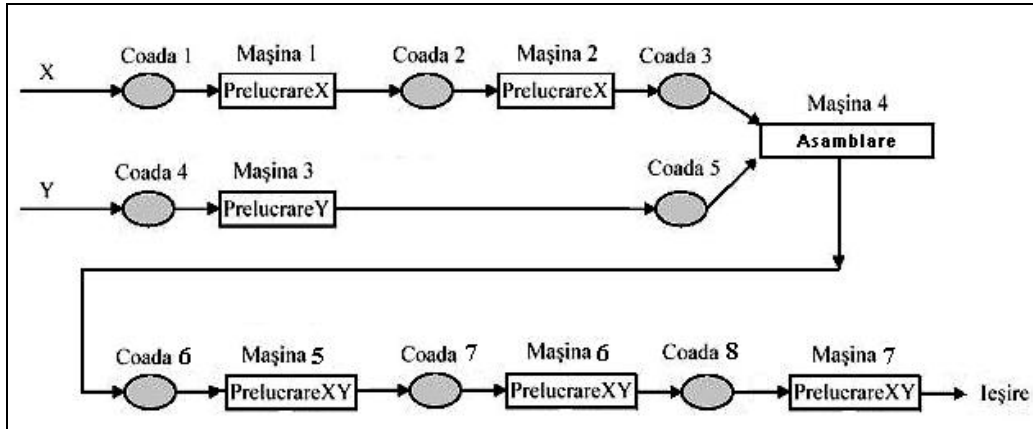


Figure 2 Workshop schedule processing, control and resistance electrical device assembly.

- Duration of intervals between two consecutive arrivals of component X is a probabilistic quantity uniformly distributed with an average 0.003 hours
- Duration interval between two consecutive arrivals of component Y is a probabilistic size with normal distribution with mean 0.003 and standard deviation hours 0.001 hours.

For units serving (seven cars) was necessary to determine the probability distributions of individual processing times, as follows:

- The processing component of X on the machine 1 is a probabilistic size with normal distribution with the average 0.003 hours per piece, and 0.0013 hours for car part 2;
- The processing component Y on machine 3 is a probabilistic size with normal distribution the average 0.008 hours per piece;
- Machine 4 assembles each piece with a piece of X Y. During the assembly is the constant 0.008 hours for a piece X and 0.008 hours for a piece of Y;
- Machine 5 devices placed in each new piece injection obtained by assembly.

Time settlement of injection devices in the song is assembled with a size probabilistic normal distribution with the average 0.016 hours per piece, injection on the machine 6, 0003 hours per piece, and release parts of the devices made with the car during the 7 hours 0.0013 / play.

For all queues was considered that the parts are processed in the order they arrive, so the choice of service discipline was FIFO (first-in first-out).

Since the storage space for components waiting to be processed is limited, we took study in two variants for maximum capacity for each queue:

Variant I: - Capacity queues 1,2,3,6,7,8 = 625 components, and components for 2500 queues 4 and 5;

Variant II: - All queues 1,2,3,4,5,6,7, 8 have storage capacity of 2500 components.

Model simulation. We considered that the system of production represented in Figure 2 is a standby.

Simulation model will be a model of discrete event simulation, and simulation experiments we conducted with the product information WINQSB module Queuing System Simulation.

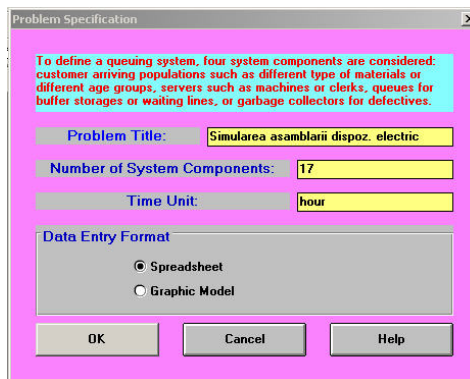


Figura 3 Fereastra de introducere a datelor.

| Component Name | Type [C/S/Q/G] | Immediate Follower [Name / Prob / TransferTime, separated by ','] | Input Rule | Output Rule | Queue Discipline | Queue Capacity | Attribute Value | Interarrival Time Distribution | Batch Size Distribution | Service Time Distribution |
|----------------|----------------|---|------------|-------------|------------------|----------------|-----------------|--------------------------------|-------------------------|-----------------------------------|
| X | C | COADA 1 | | | | | | UNIFORM/0.003/0.003 | CONSTANT/0 | |
| Y | C | COADA 4 | | | | | | NORMAL/0.003/0.001 | CONSTANT/0.003 | |
| Masina 1 | S | COADA 2 | | | | | | | | X/UNIFORM//0.003 |
| Masina 2 | S | COADA 3 | | | | | | | | X/UNIFORM//0.001 |
| Masina 3 | S | COADA 5 | | | | | | | | Y/NORMAL/0.008/0.001 |
| Masina 4 | S | COADA 6 | Assembly | | | | | | | X/CONSTANT/0.008,Y/CONSTANT/0.008 |
| Masina 5 | S | COADA 7 | | | | | | | | X/NORMAL/0.016,Y/NORMAL/0.016 |
| Masina 6 | S | COADA 8 | | | | | | | | X/NORMAL/0.003,Y/NORMAL/0.003 |
| Masina 7 | S | | | | | | | | | X/NORMAL/0.0013,Y/NORMAL/0.0013 |
| Coada 1 | Q | MASINA 1 | | | FIFO | 625 | | | | |
| Coada 2 | Q | MASINA 2 | | | FIFO | 625 | | | | |
| Coada 3 | Q | MASINA 4 | | | FIFO | 625 | | | | |
| Coada 4 | Q | MASINA 3 | | | FIFO | 2500 | | | | |
| Coada 5 | Q | MASINA 4 | | | FIFO | 2500 | | | | |
| Coada 6 | Q | MASINA 5 | | | FIFO | 625 | | | | |
| Coada 7 | Q | MASINA 6 | | | FIFO | 625 | | | | |
| Coada 8 | Q | MASINA 7 | | | FIFO | 625 | | | | |

Figure 4 Description of components.

Entering data. The screen for entering data on the size of the problem is shown in Figure 3. System components are: two types of pieces which are processed, eight stocks representing intermediate product queues waiting to be processed and seven machine which is serving stations. It follows that the production has 17 components. Unit time to be used in simulation time is.

Figure 4 presents a description of each component. Except the name of each component for all other input data required by WINQSB, was elected corresponding attribute of the predefined attributes WINQSB.

WINQSB supports four types of components: C units for clients requesting or performing an operation, the S units serving queues for Q and G for customers leaving the system without awaiting the completion of service. Column "Immediate Follower" is used to define the circuit you through each item in the system. Column "Input Rule" shows each serving stations how to select a piece of the tail which precedes. This column is particularly important especially when a service station is immediately preceded by several tails. Of rules provided by WINQSB, Assembly was elected rule.

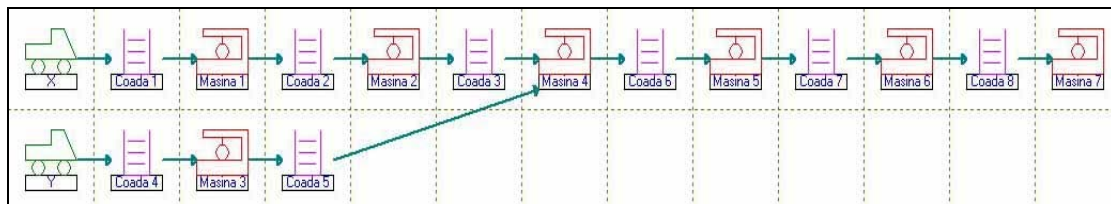


Figure 5 is a graphical representation of this system obtained by FORMAT / Switch to graphic model.

3 Result of experiments

Solving the problem begins with the commands *Solve and Analyze/Perform Simulation*. Generating the quantities involved in probabilistic models is the Monte Carlo method that uses a generator of random numbers uniformly distributed in [0, 1] and the cumulative probability distribution associated probabilities of each size. Random number generator needs an initial value (random seed). Figure 6 is presented as input data for simulation experiments and the actual simulated by the "Simulate".

Were specified 100 hours of simulation. Collecting the simulation starts from a 20-hour operation to remove the influence of the initial intermediate when stocks are zero. It was observed that the number of hours actually simulated was 100.0007 hours instead of 100 hours specified by the user. Explanation is that the simulation after completion of processing parts that are working on different machines.

WINQSB gives results for three types of analysis: analysis of clients who have entered into the system, analyzing the use of service stations and analysis of queues.

Table 1 contains information relating to the processing of the two components X and Y.

Table 1

| 06-08-2008 | Result | X | Y | Overall |
|------------|----------------------------------|-----------|-----------|-----------|
| 1 | Total Number of Arrival | 26679 | 26608 | 53287 |
| 2 | Total Number of Balking | 21680 | 21606 | 43286 |
| 3 | Average Number in the System (L) | 2499,3770 | 2500,4730 | 4999,8500 |
| 4 | Maximum Number in the System | 2505 | 2516 | 5021 |
| 5 | Current Number in the System | 2501 | 2499 | 5000 |
| 6 | Number Finished | 5000 | 0 | 5000 |
| 7 | Average Process Time | 0,0383 | 0 | 0,0383 |
| 8 | Std. Dev. of Process Time | 0,0013 | 0 | 0,0013 |
| 9 | Average Waiting Time [Wq] | 66,7560 | 0 | 66,7560 |
| 10 | Std. Dev. of Waiting Time | 17,8706 | 0 | 17,8706 |
| 11 | Average Transfer Time | 0 | 0 | 0 |
| 12 | Std. Dev. of Transfer Time | 0 | 0 | 0 |
| 13 | Average Flow Time [W] | 41,2548 | 0 | 41,2548 |
| 14 | Std. Dev. of Flow Time | 10,9882 | 0 | 10,9882 |
| 15 | Maximum Flow Time | 50,2838 | 0 | 50,2838 |
| | Data Collection: 20 to | 100 hours | | |
| | CPU Seconds = | 74,4070 | | |

Table 2 contains information about using the machine obtained by *Results / Show Server Analysis*.

In Table 3 are given information about the eight tails from the production analysis. Results in Table 3 confirms that machines 1, 2, 3, 4, 5 seats are narrow in the production process. Queue 5 preceding car 4 has the largest length and largest for waiting.

Table 2

| 06-08-2008 | Server Name | Server Utilization | Average Process Time | Std. Dev. Process Time | Maximum Process Time | Blocked Percentage | # Customers Processed |
|------------|-------------|--------------------|----------------------|------------------------|----------------------|--------------------|-----------------------|
| 1 | Masina 1 | 9,76% | 0,0015 | 0,0009 | 0,0030 | 90,65% | 5001 |
| 2 | Masina 2 | 3,14% | 0,0005 | 0,0003 | 0,0010 | 96,86% | 5001 |
| 3 | Masina 3 | 68,60% | 0,0080 | 0,0010 | 0,0115 | 10,44% | 6876 |
| 4 | Masina 4 | 50,01% | 0,0080 | 0 | 0,0080 | 50,00% | 5000 |
| 5 | Masina 5 | 100,01% | 0,0160 | 0 | 0,0160 | 0,00% | 5001 |
| 6 | Masina 6 | 18,74% | 0,0030 | 0 | 0,0030 | 0,00% | 5000 |
| 7 | Masina 7 | 8,12% | 0,0013 | 0 | 0,0013 | 0,00% | 5000 |
| | Overall | 36,85% | 0,0056 | 0,0051 | 0,0160 | 35,42% | 36879 |
| Data | Collection: | 20 to | 100 | hours | CPU | Seconds = | 74,4070 |

If each of the queues 1,2,3,4,5,6,7,8 have storage capacity of 2500 parts then that only cars 4 and 5 generates waiting queues as a result of reduced processing capacity.

Table 3

| 06-08-2008 | Queue Name | Average Q. Length (L _q) | Current Q. Length | Maximum Q. Length | Average Waiting [Wq] | Std. Dev. of Wq | Maximum of Wq |
|------------|-------------|-------------------------------------|-------------------|-------------------|----------------------|-----------------|---------------|
| 1 | Coadă 1 | 620,1115 | 621 | 625 | 9,9167 | 0,0781 | 10,0001 |
| 2 | Coadă 2 | 625,0198 | 625 | 625 | 9,9999 | 0 | 10,0005 |
| 3 | Coadă 3 | 625,0198 | 625 | 625 | 9,9999 | 0 | 10,0005 |
| 4 | Coadă 4 | 351,8006 | 0 | 1868 | 6,4573 | 7,1283 | 19,1360 |
| 5 | Coadă 5 | 2147,8860 | 2499 | 2500 | 24,6945 | 11,0843 | 39,9971 |
| 6 | Coadă 6 | 625,0198 | 625 | 625 | 9,9999 | 0 | 10,0005 |
| 7 | Coadă 7 | 0 | 0 | 1 | 0 | 0 | 0 |
| 8 | Coadă 8 | 0 | 0 | 1 | 0 | 0 | 0 |
| | Overall | 4994,8580 | 4995 | 2500 | 8,7752 | 8,5578 | 39,9971 |
| Data | Collection: | 20 to | 100 | hours | CPU | Seconds = | 74,4070 |

By doubling machine 4 and 5, according to Table 4 and Figure 6 is found that all the queues have disappeared. Analysis of simulation results can be made based on graphs which provides WINQSB.

In Figure 7 a and b are given the average and maximum lengths of the queues for the model variants 1 and 3, which, if the production system analysis, stocks are intermediate.

Table 4

| 06-08-2008 | Queue Name | Average Q. Length (Lq) | Current Q. Length | Maximum Q. Length | Average Waiting (Wq) | Std. Dev. of Wq | Maximum of Wq |
|-------------|--------------------|------------------------|-------------------|-------------------|----------------------|------------------|----------------|
| 1 | Coadă 1 | 0,8141 | 1 | 1 | 0,0065 | 0,0012 | 0,0107 |
| 2 | Coadă 2 | 1,0000 | 1 | 1 | 0,0080 | 0,0009 | 0,0115 |
| 3 | Coadă 3 | 1,0000 | 1 | 1 | 0,0080 | 0,0009 | 0,0115 |
| 4 | Coadă 4 | 0,7902 | 1 | 1 | 0,0063 | 0,0015 | 0,0110 |
| 5 | Coadă 5 | 0,2146 | 0 | 1 | 0,0017 | 0,0027 | 0,0093 |
| 6 | Coadă 6 | 0,7792 | 1 | 1 | 0,0062 | 0,0028 | 0,0093 |
| 7 | Coadă 7 | 0 | 0 | 1 | 0 | 0 | 0 |
| 8 | Coadă 8 | 0 | 0 | 1 | 0 | 0 | 0 |
| | Overall | 4,5979 | 5 | 1 | 0,0046 | 0,0036 | 0,0115 |
| Data | Collection: | 20 to | 100 | hours | CPU | Seconds = | 99,7030 |

4 Conclusions

The advantages of using simulation to WINQSB theory yarns instead of waiting are:

- a simulation can be pursued more easily in the time of the system;
- a mathematical theory yarns waiting is difficult and can be applied only for certain statistical probability distributions in While the theory of mathematical simulation is simple and can deal with any statistical probability distributions;
- the simulation is more easily understood by managers compared to theory yarn waiting. In Table 5 are presented the summary results for the three model variants analyzed.

Table 5

| | Varianta 1 | Varianta 2 | Varianta 3 |
|---|------------|------------|------------|
| Nr. total produse finite | 5000 | 5000 | 9975 |
| Timpul total mediu de prelucrare a unui produs finit (h/prod) | 0,0383 | 0,0383 | 0,0383 |
| Timpul total mediu de aşteptare a unui produs finit (h/prod). | 66,75 | 56,89 | 0,0369 |
| Lungimea medie Coadă 1 | 620,11 | 0 | 0,81 |
| Lungimea medie Coadă 2 | 625,01 | 0 | 1,0 |
| Lungimea medie Coadă 3 | 625,01 | 1506,81 | 1,0 |
| Lungimea medie Coadă 4 | 351,8 | 510,70 | 0,79 |
| Lungimea medie Coadă 5 | 2147,88 | 639,08 | 0,21 |
| Lungimea medie Coadă 6 | 625,01 | 2340,16 | 0,77 |
| Lungimea medie Coadă 7 | 0 | 0 | 0 |
| Lungimea medie Coadă 8 | 0 | 0 | 0 |
| Grad de utilizare Maşina 1 | 9,26% | 11,05% | 18,86% |
| Grad de utilizare Maşina 2 | 3,14% | 3,80% | 6,21% |
| Grad de utilizare Maşina 3 | 68,60% | 71,53% | 99,63% |
| Grad de utilizare Maşina 4a | 50,01% | 62,66% | 49,66% |
| Grad de utilizare Maşina 4b | - | - | 50,1% |
| Grad de utilizare Maşina 5a | 100,01% | 100,01% | 99,73% |
| Grad de utilizare Maşina 5b | - | - | 99,73% |
| Grad de utilizare Maşina 6 | 18,74%% | 18,74% | 37,39% |
| Grad de utilizare Maşina 7 | 8,12% | 8,12% | 16,20% |

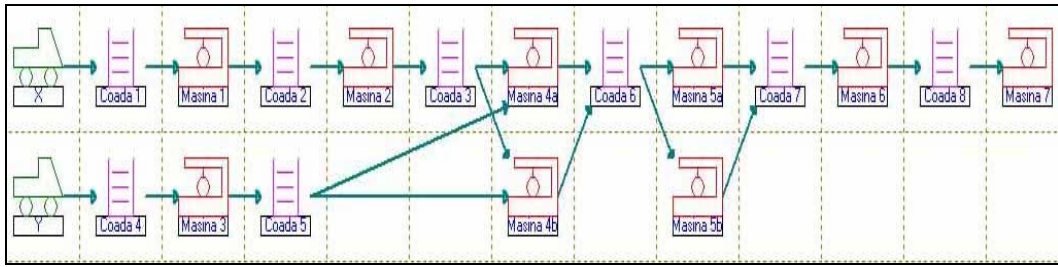


Figure 6 Graphical representation of the system obtained by FORMAT / Switch to graphic Model.

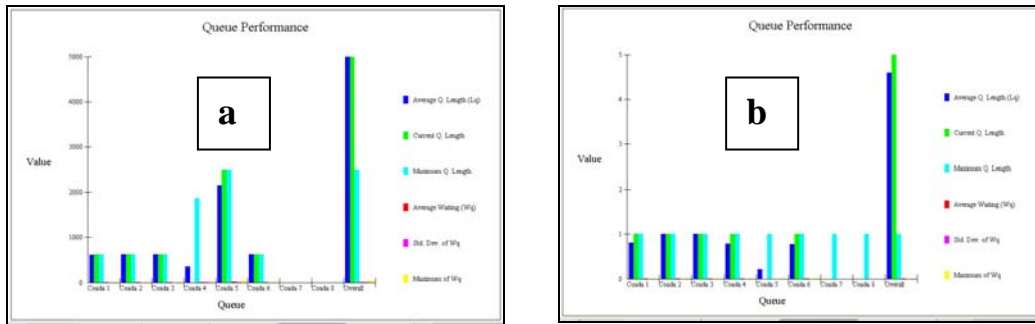


Figure 7 Analysis of queues.

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THE OPPORTUNITY FOR REINVENTORIED FLOATING CRANE

Violeta POPESCU¹

Hazel MENADIL²

¹ Conf. dr.ing., Universitatea Ovidius Constanța

² Șef Lucrări ing., Universitatea Ovidius Constanța

Abstract: *In the current conditions of port operations, respectively port terminals, there becomes more obvious the need to be used, in addition to existing docks equipment, modern floating equipments for ships operations. The conditions that are appropriate for reinventing of port cranes are:*

- *The size and deadweight capacity of all types of ships have increased, so that, not all ports have the necessary conditions for receipt and / or their operation in a convenient time (limited depth of water in the basin, the crane arm length corresponding width vessel, large number of cranes);*

- *Increasing ships demands increasing areas of land of port terminals for storing the import / export goods;*

- *Increasing container traffic in certain areas has caused congestion of major ports, resulted in formation waiting String of ships and means of road transport of containers in entry-port, which affect logistics of the distribution chain of goods, with the result of increased costs of crossing vessels in port and reducing profit;*

- *The economic crisis increases the risk of major investment in berths construction with classical facilities for operating vessels, so a floating crane is cheaper, it can operate in the port basins, in open sea or navigable channel, anywhere requires the recipient.*

So, the concept of floating crane comes back in force in port activity with new perspectives and advantages. The paper brings into question new types of floating equipment for transshipment of solid bulk and containers.

Keywords: *port equipment, floating crane, floating terminal.*

1. The classical floating cranes

The first floating cranes used in maritime and driver ports appeared in 1950...1960, with the purpose of replacing the infrastructure destroyed by the 2-nd World War.

Being made of a crane carried by a pontoon (bridge), the classical floating crane played an important part in operating goods in ports, being used mainly for:

- Unloading-loading some oversize / great weight goods on the vessels deck, the crane being positioned between the ship and quay;
- Transshipment goods between a maritime ship and a river one, in which case the crane is positioned between the two ships.

2. The new floating cranes generation

The new floating cranes generation represents the reinvention of the old floating cranes, required by economic and ecological reasons, so that it can answer the actual port demands, among which:

- The possibility of great ships operation, which cannot be admitted in the port, at an existing operation berth, because of the insufficient water depth in the port basin, the locks dimensions etc.;
- The operation of goods with minimum cost, especially those cheap (solid bulk);
- The transshipment of goods from ship to ship (for example transshipment bulk goods from the maritime ships directly to the barge);
- Increasing the operation productivity, when the quay cranes number is small;
- Operating ships in open sea or in the roads for eliminating the quay expenses.

The modern concept for floating crane is different, as the crane project is personalized according to the customers' demands, with various supplies:

- Equipment for goods operation: facility for multipurpose handling, crane with grab, conveyor for operating solid bulk goods, portainer crane with spreader, platform for the Ro/Ro system, accommodation space etc.;
- Specially arranged areas for goods storing (storehouses situated in pontoon or storing surfaces on deck);
- It can perform loading-unloading and transshipment operations in maritime a driver ports and in open sea;
- It can/cannot have own propulsion;
- It can carry goods inside the maritime port or even further on the navigable ways to the interior port.

The main advantages of these floating equipments are: autonomy, reduced investment costs, reduced delivery time, high fiability, prolonged usage time, safe operating (however, manufacturers recommended that the transshipment operations should be performed in relatively sheltered areas, with about 1 metre high waves and 50 km/h winds.

The floating terminal represents a ship operating in open sea, with a great storing capacity, capable to carry out loading, unloading, transshipment operations and goods storing.

3 Floating crane for operating cellular container ships

Container ships have constantly increased the dimensions and capacity (for example the each ships „Emma Maersk” and „Estelle Maersk” has a capacity of 11000 TEU) with the purpose of obtaining the scale economy, but the station time in ports is to remain to maximum 24 hours so that they may be efficient. This requirement imposes adaptations for the container port terminals which necessitate huge investments:

- 1 - Expanding water depth in the ports basins corresponding to the new draft ships;
- 2 - Adapting the quay crane arm to the shops width (by adapting the existent cranes or acquiring new cranes).
- 3 - Enlarging the land surface of terminals according to the ships loading capacity;
- 4 - Increasing the existent cranes productivity;
- 5- Increasing the cranes number with which the ship can be operated simultaneously.

As the number of the quay specialised cranes that can simultaneously operate at a ship is limited (maximum 6 -7 cranes, depending on cargo-plan), a floating crane specialised for containers (or more), that would work at the same ship, but on the seaside, constitutes a good solution for increasing productivity and reducing the ship station time in port. Operating the container ship on both sides (from quay and from the sea) can be fulfilled in two ways:

a) The ship is moored in a special basin [, in a niche form, in order to be operated by quay cranes plane do booth sides (Fig.1.). The solution necessitates important investments.

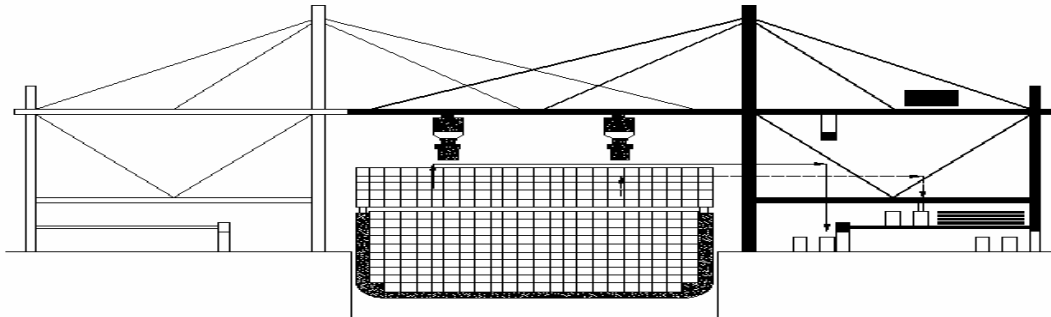


Fig. 1.

b) The ship is moored at the container terminal and it is operate at the land side with quay cranes and, at the seaside with specialised floating cranes [3] (Fig.2.).

The floating crane for containers operation (self-propelled or towed) consists of a containers specialised crane, place don two pontoons, on which it can store a number of containers. The second solution presents several advantages, among which:

- It increases the terminal productivity;
- It involves more reduced costs;
- The mobility of the floating crane permits its usage anywhere it is necessary;
- The possibility of the crane to store containers, which afterwards will be transported and store at the desired place;
- It contributes to easing congestion and helps mitigate pollution container terminal;
- It permits transhipment the containers between the main ship and the feeder ship (which distribute the containers to inland terminals through inland waterways).

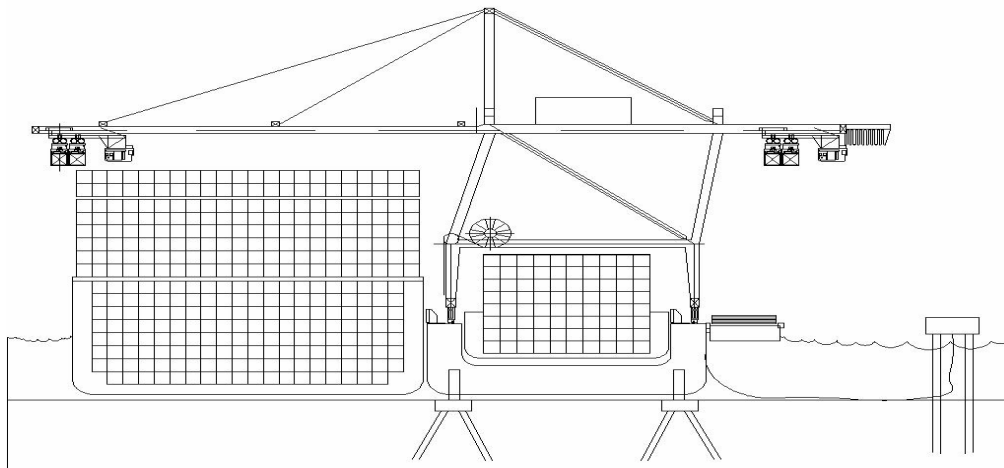


Fig. 2.

Due to the functions it can perform (loading-unloading on/off the ship, transhipment between two ships and storing), such a floating crane constitutes a floating terminal.

A container mobile floating terminal can work on navigable canals or in open sea, it make use of cranes placed on barge or pontoons, which posed storing surfaces for more 200 TEU (Twenty-foot Equivalent Unit).

The containers are stored at the bou and stern, so that it can maintain the stability of the ship and improve the crane working cycle time, by minimizing the spreader oscillations at the containers positioning. In order to obtain a better trim of the ship, the terminal is supplied with ballast tanks.

This terminal represents the best solution for ports situated at deep sea witch have connexions with inland navigable ways (Hong-Kong, Shanghai, Constanta) as well as for very congested and pullulated ports, which require extension.

The terminal is effectively a dedicated offshore shipping hub which enables the transfer of containers directly to smaller feeder vessels, which will in turn tranship containers onward to smaller ports. This design will enable vessels to deliver containers much closer to their final destination through short sea shipping, and thus reduce the land transport requirement considerably.

3.1. The floating terminal for ships operation which transport solid bulk goods

Considering the severe competition among the maritime transport of solid bulk goods (coal, ore) on are looking solutions for improving the transport efficiency by using bigger and more performing ships and reducing the transport costs – as an important part of the goods delivery cost sat the final utilizes [2]. However, not all ports can adopt to receiving and operating big ships.

For these reasons, to which the conditions of the present recessions are to be considered, the floating terminal for the mechanical operation of the solid bulk goods constitutes an optimum solution: it is more rapid and cheaper than acquisition and installing the quay classical crane, it has a neglect able impact over the environment as compared with the classical quay equipment and it can operate where the customer wishes, and there is no need for the berth.

The floating berth consists of a crane with grab set on a pontoon and it can transhipment the goods between the maritime ships place don a board of the crane and the river ship (barge) situated on the other board.

There are variants where the floating crane is supplied with storehouses for the temporary storing of the goods, so that, if the barges are not available, the unloading operation of the maritime ship should not be interrupted.

In order to take over the goods off the storehouses of „the terminal” this is supplied with screw conveyors closed in carcasses (for preventing the dust emissions and goods brakeage into the water), which take over, transport and deliver the goods at the barge or at land, at the unloading place [1, 4]. The whole self-propelled equipment can be used for goods transporting from one berth to another, from one port to another.

The operation theoretical productivity of the ships in the open sea, with such equipment, is varied from 18 000 t/day to 25 000 t/day depending on options.

In the same way the floating terminals supplied with pneumatically equipment, for loading-unloading and transhipment powdery cargo (especially grains).

4. Conclusions

Designing and building a classical port terminal implies risks and very high effective costs, which in the end will be felt by the final users of the maritime transport.

The excessive investments and the important impact on the environment which the building of a classical port terminal supposes, and the risk of not covering the costs as a consequence of the economic fluctuations and the rapid evolutions of the ships and port technology, all these may determine the deciders to take into account other alternative solutions as well, among which the new floating equipments (floating cranes with personalised supplies which can became real floating terminals) correspond to the actual situation the best, offering new advantages and perspectives at the same time.

Initially used in offshore oil and gas sector, the new technology is also used for floating solutions in dry cargo markets.

The offshore transhipment terminals represent a valid alternative to fixed port infrastructures. Among their other advantages, offshore transhipment terminals have the peculiarity of being used “on demand”.

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MODEL ADDITIVE-INCREASE AND MULTIPLICATIVE-DECREASE FOR THE STREAMING MEDIA

Ioan POPOVICIU¹

¹ conf. univ. dr. Popoviciu Ioan Naval Academy “Mircea cel Batran” Constantza

Abstract: *Streaming media is sensitive to delay and jitter, but can tolerate some data loss. Thus, TCP with reliable transmission service at the cost of potentially large delay at congestion may not be an optimal choice for streaming applications. For these reasons, streaming media applications often use UDP as a transport protocol rather than TCP. A non-TCP protocol is called TCP-friendly when it yields the same throughput as traditional TCP. TCP-friendly protocols are generally used for multimedia/real-time applications. This paper proposes a TCP-friendly protocol model for the streaming media.*

Key words: TCP, congestion, AIMD, QoS, friendly

1. Introduction

The Internet is a collection of interconnected networks that offer a best-effort data transmission service to users using the Internet Protocol (IP). The current Internet relies on the end-host congestion avoidance mechanisms of modern TCP to resolve traffic congestion and prevent congestion collapse. Modern TCP traffic sources monitor their own transmission to detect network packet losses, take them as implicit congestion signals from routers and reduce their transmission rate to avoid congestion using bandwidth adaptation mechanisms. The congestion avoidance bandwidth adaptation behavior of TCP is mainly characterized by the Additive Increase Multiplicative Decrease (AIMD) algorithm.

In the network, IP routers use outbound queues to accommodate traffic bursts and achieve high link utilization. Most current routers use FIFO queues that passively drop incoming packets when queues are full. Unfortunately, when faced with persistent congestion, FIFO drop-tail queues, often over-provisioned with large buffers to yield maximum throughput, oscillate and fill up resulting in high transmission delays. Also, the simple drop-tail queue mechanism is open to the threat of congestion collapse due to a malicious or even unintentional misuse of the network. Moreover, FIFO queues have difficulty in satisfying the diverse network service requirements of today's applications, especially the ever more popular delay sensitive applications. The congestion control challenges the current Internet faces can be categorized into three sub-problems: first is to improve network support for an efficient congestion control feedback system; second is to protect the network from potentially misbehaving or unresponsive traffic; third is to concurrently support various Internet application domains with diverse Quality of Service (QoS) requirements.

2. Congestion control

The efforts to improve the congestion control feedback system can be divided into two approaches. The first approach is to completely redesign a congestion control feedback system by replacing both the TCP congestion avoidance mechanism and the router traffic management mechanisms. This type of approach has the potential to achieve a highly efficient congestion control structure, but faces the possibly insurmountable problems of gradual deployment. The second approach is to replace drop-tail queue management with Active Queue Management (AQM) in order to enhance network support for end-to-end congestion control. AQM enabled routers include a congestion controller unit that detects and notifies end-systems of impending congestion, allowing responsive traffic sources to reduce transmission rates before the congested router queue overflows. When properly designed and configured, AQM can offer a low queuing delay while achieving high link utilization. Moreover, since AQM routers are able to predict impending congestion before buffer overflows they may explicitly signal end-systems of network congestion by marking the Explicit Congestion Notification

(ECN) bit in the IP headers. ECN improves congestion notification efficiency and system goodput over implicit packet-drop congestion notification by avoiding network packet losses. Yet another gain from the early congestion prediction is that routers have a choice in selecting to which end-hosts to signal congestion. By fairly notifying end-hosts of congestion proportion to their usage, an AQM router may improve bandwidth distribution fairness over drop-tail queue management.

The efforts to protect the network from potentially misbehaving or unresponsive traffic can be made both at end-systems and routers. The Internet research community is trying to build TCP-Friendly transport protocols for applications that cannot benefit from using TCP but would rather use UDP. At the same time, drastic approaches to protect the network or to enforce bandwidth distribution fairness at routers have been proposed. The bandwidth controller units are often designed as a part of the AQM mechanisms. The efforts to concurrently support various Internet application domains with diverse QoS requirements are made mainly at the network service architecture level. The Internet research community is considering restructuring the service architecture to support differentiated classes of service, known as the Differentiated Services (DiffServ) architecture. The DiffServ architecture can offer a variety of network services that may be sufficient to support the diverse QoS requirements of different Internet applications. However, what services should be offered, how to configure network components to support specific services or how to price services are very complex challenges not yet resolved. Furthermore, gradual employment of DiffServ is non-trivial since it requires a different network service interface from that of the current Internet.

Alternatively, a few approaches have been made to offer a limited support for QoS such as controlling delays and packet loss rates using a QoS packet scheduling instead of FIFO scheduling discipline. These mechanisms consider delay requirement hints in each IP header and tradeoffs the delay gain with the throughput loss and vice versa using a QoS scheduling queue control unit. The merit of the delay-throughput exchange approaches is that they require a minor modification to the Internet service interface and IP header, and provide a “better-than-best-effort” service. However, a concern is that the delay-throughput exchange mechanisms may not preserve fairness among flows, since routers may not be able to collect and use all the information required to ensure fairness due to the information acquiring complexity and overhead. Moreover, few were able to provide a suitable support for the diverse delay requirements. The delay sensitivity of the QoS requirements makes the Internet support for QoS more difficult rather than the variety of the QoS requirements. For example, concurrently satisfying throughput sensitive FTP and Email applications is relatively easy compared to concurrently satisfying Web browsing and Internet videophone applications because of the stricter delay

constraints imposed by the latter applications. From this simple observation, we can deduce that if the queuing delays at the congested routers can be minimized even at the cost of a small decrease in link utilization, a significant number of QoS issues will be reduced. In other words, if the current Internet cannot handle diverse delay QoS requirement, a possible solution other than a network service structure change, which requires time, vast investment and risk, is to significantly reduce network delays.

The Internet can offer “best-delay-effort” service without any change in the service architecture or interface using a delay optimized AQM at routers improving both the congestion control efficiency and the support for diverse QoS requirements. A delay optimized AQM minimizes queuing delay by making early and efficient imminent congestion prediction based on the incoming traffic rate rather than on the queue length. An analogy is a preemptive time-sharing machine that configures its time-slice length for the QoS needs of interactive applications can support both the interactive and computation-rich applications concurrently up to a certain workload. Likewise, a best-delay-effort Internet could concurrently serve various applications with different delay constraints.

In addition to improving efficiency and QoS, it is inevitable that the next generation Internet should offer the public network affordable protection from threats of potentially misbehaving or unresponsive traffic. The current Internet allows applications to use the network with arbitrary data rates and congestion response, potentially in a harmful way. Protection of the public network may not be a practically important problem when the majority of Internet applications uses TCP. However, it becomes serious with the growth of delay sensitive applications such as streaming media, which often prefer UDP over TCP as their transport protocol choice. Moreover, the growth of the end-user Internet connection capacity further increases the level of threats from misbehaving or unresponsive flows due to the increased traffic volume limits of each flow.

Streaming media is sensitive to delay and jitter, but can tolerate some data loss. Thus, TCP with reliable transmission service at the cost of potentially large delay at congestion may not be an optimal choice for streaming applications. Recent research has proposed rate-based TCP-Friendly protocols in the hope that streaming media applications will use them, but such protocols are not yet widely part of most operating system distributions. For these reasons, streaming media applications often use UDP as a transport protocol rather than TCP. Moreover, with the use of repair techniques, UDP packet losses can be partially or fully concealed, reducing the impact of loss on the quality of the media by the user, and thus reducing the incentive for multimedia applications to lower their bitrate in the presence of packet loss during congestion. Moreover, as the end-user Internet connection capacity offered by Internet Service Providers (ISP) has significantly increased (up to 3 Mbps for typical cable modem services), even the highest quality media, about 2-4 Mbps for broadcast quality video, can be streamed without imposing congestion at the local Internet connection links. Thus, high-bandwidth Internet connections are pushing the streaming media performance bottleneck closer to the servers threatening the well-being of the public Internet.

3. TCP-friendly protocol model for the streaming media **Model additive-increase and multiplicative-decrease (AIMD)**

A TCP-like window-based congestion control scheme increases the congestion window as a result of the successful transmission of a window of packets, and decreases the congestion window upon the detection of a packet loss event. We call such a sequence of window increments followed by one window decrement a *congestion sequence*. A window-based congestion control scheme defines one control rule for window increase, and another rule for window decrease. AIMD uses the following control rules:

$$\text{Increase: } w_{t+1} \leftarrow w_t + \alpha, \alpha > 0$$

$$\text{Decrease: } w_t \leftarrow w_t - \beta w_t, 0 < \beta < 1$$

where W_t is the window size at time t (in round-trip time RTTs). That is, for AIMD, the window size is increased by a constant when a window of packets are transmitted successfully, and it is decreased by a constant factor instantaneously when a packet loss event is detected. Binomial controls generalize AIMD and use the following control rules:

$$\text{Increase: } w_{t+1} \leftarrow w_t + \frac{\alpha}{w_t^k}, \alpha > 0$$

$$\text{Decrease: } w_t \leftarrow w_t - \beta w_t^l, 0 < \beta < 1$$

That is, binomial controls generalize additive-increase by increasing inversely proportional to a power k of the current window, and generalize multiplicative-decrease by decreasing proportional to a power l of the current window.

AIMD and binomial controls are memoryless since the increase and decrease rules use only the current window size W_t and constants (α, β, k and l). The window size at the end of the last congestion epoch is useful, not only as an indicator of the current congestion level of the network, but also as a good predictor of the congestion state for the next sequence. Thus, our proposed scheme maintains such a state variable W_{\max} , which is updated at the end of *each* congestion sequence. In addition, let W_0 denote the window size after the decrease. Given a decrease rule, W_0 can be obtained from W_t , and *vice versa*.

For example, for AIMD, $w_0 = (1 - \beta)w_{\max}$. Henceforth, for clarity, we use both W_{\max} and W_0 .

We propose to adopt the following window increase function:

$$w(t) = w_0 + c * t^u, u, c > 0 \tag{1}$$

where $w(t)$ is the continuous approximation of the window size at time t (in RTTs) elapsed since the window started to increase. By definition, $w(0) = W_0$. This window increase function is equivalent to the following window increase rule:

$$w_{t+1} \leftarrow w_t + \alpha / (w_t - w_0)^k, \alpha > 0 \tag{2}$$

where $k > -1$ and α is independent of t . In particular, $u = 1/(k+1)$ and $c = ((k+1)\alpha)^u$. We are interested in congestion control schemes that have various window size increase patterns (different u 's, or equivalently, different k 's). Consider three cases. First, if $-1 < k < 0$, the congestion window increases super-linearly. The window is increased cautiously just after the detection of packet loss, and the increase becomes more and more aggressive when no more loss occurs. Second, if $k = 0$, the window increases linearly, i.e., additive increase. The aggressiveness does not change with time. Third, if $k > 0$, the window increases sublinearly. The connection approaches the previously probed window size fast, but it becomes less aggressive beyond that. These various schemes possess different degrees of aggressiveness, and may satisfy different applications. For example, super-linear increase can support applications that need to quickly acquire bandwidth as it becomes available. Therefore, we consider the following control rules:

$$\begin{aligned} \text{Increase: } w_{t+1} &\leftarrow w_t + \alpha(w_{\max})^u (w_t - w_0)^k, \alpha(w_{\max}) > 0 \\ \text{Decrease: } w_t &\leftarrow w_t - \beta w_t^l, 0 < \beta < 1 \end{aligned} \quad (3)$$

Note that we write α as a function of w_{\max} since this is required in the derivation of TCP-friendliness. In the remainder of this paper, we simply write α for clarity. We use the same decrease rule as binomial controls. For the increase rule, we consider $k > -1$, since otherwise the window size increases exponentially or faster and we consider it unstable. For the decrease rule, we consider $l \leq 1$, since otherwise $(w_t - \beta w_t^l)$ can be negative when w_t is large enough.

We show that this control can be TCP-friendly by appropriately defining α as a function of the constant β and the state variable w_{\max} . This control is radically different from binomial controls, because binomial controls generalize AIMD, but they are still in the memoryless space.

We show that this control scheme using the control rules in (3) can be TCP-friendly. The notion of TCP-friendliness refers to the relationship between throughput and packet loss rate. We consider a random loss model, where the losses are Bernoulli trials; packets are dropped uniformly with a fixed probability, and following definition of α to make congestion control scheme TCP-friendly:

$$\alpha = \frac{3}{2(k+1) \left(1 - \frac{1}{k+2} \beta w_{\max}^{l-1}\right)} \left(\frac{\beta}{\Gamma\left(\frac{1}{k+1} + 1\right)} \right)^{k+1} w_{\max}^{kl+l-1} \quad (4)$$

where the Gamma function $\Gamma(\cdot)$ is a constant. According to formula (1), C in (1) is defined as a function of α and we have

$$c = \left(\frac{3}{2 \left(1 - \frac{1}{k+2} \beta w_{\max}^{l-1}\right)} \right)^{\frac{1}{k+1}} \frac{\beta}{\Gamma\left(\frac{1}{k+1} + 1\right)} w_{\max}^{l - \frac{1}{k+1}} \quad (5)$$

When the window size variation is small, i.e., the window decrease is small, $\beta w_{\max}^l \leq w_{\max}$, we can simplify α and C as

$$\alpha \approx \frac{3}{2(k+1)} \left(\frac{\beta}{\Gamma\left(\frac{1}{k+1} + 1\right)} \right)^{k+1} w_{\max}^{kl+l-1} \quad (6)$$

$$c \approx \left(\frac{3}{2} \right)^{\frac{1}{k+1}} \frac{\beta}{\Gamma\left(\frac{1}{k+1} + 1\right)} w_{\max}^{l - \frac{1}{k+1}} \quad (7)$$

α is a constant factor of w_{\max}^{kl+l-1} and C is a constant factor of $w_{\max}^{l - (l/k+1)}$. Table 1 gives several special cases, control rules and the window increase functions. When $k = 0$ and $l = 1$, from (4) we have $\alpha_{AIMD} = 3\beta(2 - \beta)$. If

$\beta \leq 1$, $\alpha_{AIMD} \approx 3\beta/2$ it degenerates to the memoryless TCP-friendly AIMD control. When $k = -0.5$ and $l = 1$ we have square-increase/multiplicative-decrease (SIMD)

$$\alpha_{SIMD} = \frac{3\sqrt{\beta}}{\left(1 - \frac{2\beta}{3}\right)\sqrt{2w_{\max}}} \quad (8)$$

If $\beta \leq 1$, $\alpha_{SIMD} = \frac{3\sqrt{\beta}}{\sqrt{2w_{\max}}}$. In this case, the window size decreases multiplicatively upon the detection of packet loss, but increases in proportion to the *square* of the time elapsed since the detection of the last loss event (cf. Table 1). We call this control square-increase/multiplicative-decrease.

Table 1

| (k, l) | Increase rule | Decrease rule | Increase function |
|-------------------------|--|--------------------------------|--|
| $k = 0, l = 1, AIMD$ | $w_{t+1} = w_t + 3\beta / (2 - \beta)$ | $w_t = w_t - \beta w_t$ | $w(t) = w_0 + (3\beta / (2 - \beta))t$ |
| $k = -1/2, l = 1, SIMD$ | $w_{t+1} = w_t + \frac{3\sqrt{\beta}}{\sqrt{2(1 - 2\beta/3)}} \sqrt{\frac{w_t - w_0}{w_{\max}}}$ | $w_t = w_t - \beta w_t$ | $w(t) = w_0 + \frac{9\beta}{8(1 - 2\beta/3)^2} \frac{1}{w_{\max}} t^2$ |
| $k = 0, l = 1/2$ | $w_{t+1} = w_t + 3\beta / (2\sqrt{w_{\max}} - \beta)$ | $w_t = w_t - \beta \sqrt{w_t}$ | $w(t) = w_0 + (3\beta / (2\sqrt{w_{\max}} - \beta))t$ |

4. Conclusion

We proposed a TCP-friendly protocol model for congestion controls. It are TCP-friendly and TCP-compatible under queue management. It possess different smoothness, aggressiveness, and responsiveness tradeoffs. Thus, instances from this applications can be chosen as the transport schemes of various applications, for example, streaming applications on the Internet which are required to be TCP-friendly. In particular, we presented simulation results of SIMD, AIMD as special instances. Analysis were used to demonstrate the TCP-friendliness and TCP-compatibility of congestion controls and they can solve the problem raised by slowly responsive congestion controls.

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HEAT PIPE BASICS

Dan POTROCEA¹

¹Chief Engineer Post Graduate, Maritime Expert Advisor, Romanian Maritime Training Center

Abstract: A heat pipe is a device that efficiently transports heat from its one end to the other. It utilizes the latent heat of the vaporized working fluid instead of the sensible heat. As a result, the effective thermal conductivity may be several orders of magnitude higher than that of the good solid conductors.

Heat input at the evaporator vaporizes the working fluid and this vapor travels to the condenser section. Here the latent heat is rejected via condensation. The vapor of the working fluid condenses and the condensate returns to the evaporator by means of capillary action.

Key words: heat pipe, thermal conductivity, vaporized working.

Construction

A heat pipe consists of a sealed container, a wick structure, a small amount of working fluid that is just sufficient to saturate the wick and it is in equilibrium with its own vapor.

Figure 1 shows a schematic of a heat pipe operation.

The operating pressure inside the heat pipe is the vapor pressure of its working fluid.

The length of the heat pipe can be divided into 3 parts viz. evaporator section, adiabatic section and condenser section.

In a standard heat pipe, the inside of the container is lined with a wicking material. Space for the vapor travel is provided inside the container.

Fins may be attached to the evaporator and the condenser portion to increase heat transfer rate depending upon the application.

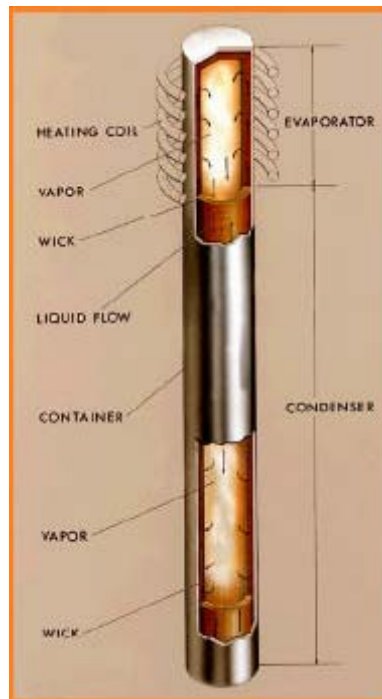


Figure 1. Cut-away Diagram of a Heat Pipe

Operating principle

A heat pipe operates on a closed two phase cycle. Figure 2 shows a schematic of a typical heat pipe operation. As previously mentioned, there is liquid-vapor equilibrium inside the heat pipe. When the heat is supplied to the evaporator, this equilibrium breaks down as the working fluid evaporates. The generated vapor is at a higher pressure than the liquid and it travels to the condenser section through the vapor space provided. Vapor condenses giving away its latent heat of vaporization to the heat sink. The capillary pressure created in the menisci of the wick pumps the condensed fluid back to the evaporator section.

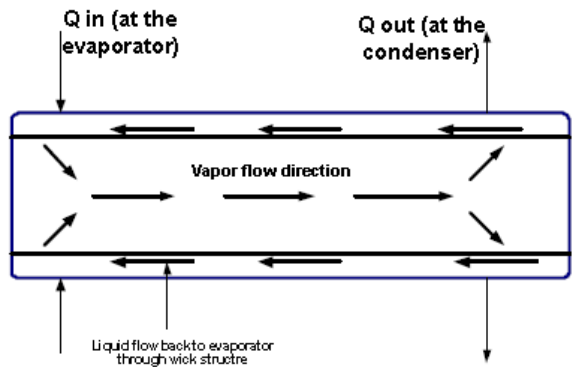


Figure 2. Schematic of a typical heat pipe operation

The cycle repeats and the heat is continuously transported from evaporator to condenser in the form of latent heat of vaporization.

When heat is applied to the evaporator, the liquid recedes into the pores of the wick and thus the menisci at the liquid-vapor interface are highly curved.

This phenomenon is shown in Figure 3.

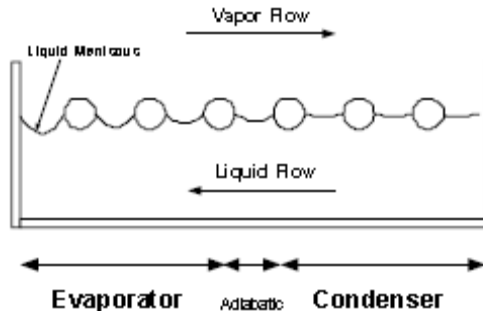


Figure 3. Variation of meniscus curvature as a function of axial position

At the condenser end, the menisci at the liquid-vapor interface are nearly flat during the condensation.

The difference in the curvature of menisci driving force that circulates the fluid against the liquid and vapor pressure losses and body forces such as gravity (if there is an adverse tilt with respect to the ground).

Heat pipe theory

There are different heat transfer limits that govern the performance of a heat pipe. These will be discussed in brief in this section.

1. The working fluid

Every heat pipe application has a particular temperature range in which the heat pipe needs to operate. As a rule of thumb, the useful range extends from the point where the saturation pressure is greater than 0.1 atm and less than 20 atm. (Faghri, 1995). Below 0.1 atm, the vapor pressure limit may be approached while above 20atm, the container thickness must be increased to a point where the heat pipe operation is limited by the increased thermal resistance. The important requirements of a wick structure are listed below:

- Should be compatible with the wick and container material
- High latent heat
- High thermal conductivity
- High surface tension
- Low liquid and vapor viscosities
- Wettability of wick and wall materials

2. The wick

The wick structure in a heat pipe facilitates liquid return to the evaporator from the condenser. The main purposes of the wick are to generate the capillary pressure, and to distribute the liquid around the evaporator section of heat pipe. Figure 4 shows various wick structures.

The most commonly used wick structure is a wrapped screen wick. At this point, we will define a parameter called 'Mesh Number' which is used to specify a particular wrapped screen wick. It is defined as the number of wires per linear inch, counted from the center of any wire to a point exactly one inch distant, including the fractional distance between wires thereof.

For example a mesh number of 60 per inch can be interpreted as 60 × 60 mesh wires per inch.

A mesh could be square or rectangular mesh. Obviously, higher mesh number represents a finer grid.

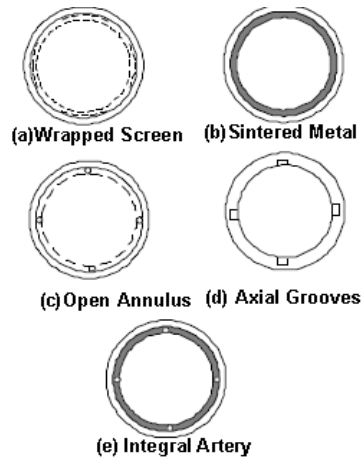


Figure 4. Various Wick Structures

Heat pipe thermal resistance

The temperature drop between the heat pipe condenser and the evaporator can be found by utilizing an analogous thermal resistance concept. (Peterson, 1994).

Figure 5 represents the overall thermal resistance in a standard heat pipe.

As shown in the figure, there are nine thermal resistances arranged in a series parallel combination. The suffix 'e', 'c' and 'a' denote the evaporator, condenser and the adiabatic section thermal resistances respectively.

These resistances are summarized as follows:

- ✚ R_p = Pipe wall resistance
- ✚ R_w = Resistance of liquid-wick combination
- ✚ R_i = Resistance of liquid-vapor interface
- ✚ $R_{v,a}$ = Resistance of adiabatic vapor section
- ✚ R_{ext} = External Resistance

It is seen that R_p , R_w and R_{ext} play an important role in the thermal resistance calculations. The parallel resistances for the adiabatic section shown in the figure are insignificant because of the fact that the resistance $R_{v,a}$ is generally of the magnitude of 10^{-8} °C/W which is far less than the other two resistances (which are generally of a magnitude of 10^{-3}) and since these resistances are in parallel, they cancel out.

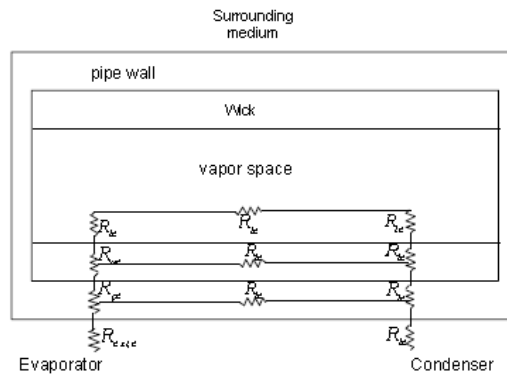


Figure 5. Thermal resistance of a heat pipe

The radial resistance of the pipe wall can be obtained by using Fourier's law as,

$$R_p = \frac{\ln(d_o / d_i)}{2\pi L_e k_p}$$

An expression for equivalent thermal resistance of liquid wick combination is,

$$R_w = \frac{\ln(d_o - d_i)}{2\pi L_e k_{eff}}$$

where, k_{eff} is the effective thermal conductivity of the heat pipe and typical expressions are listed in Table 1 (Chi,1976).

Table 1. Effective thermal conductivity of liquid saturated wick structures

| Wick Structures | k_{eff} |
|---------------------|--|
| Wrapped Screen | $\frac{k_i [(k_i + k_w) - (1 - \varepsilon)(k_i + k_w)]}{\varepsilon k_w + k_i (1 - \varepsilon)}$ |
| Rectangular Grooves | $\frac{\omega_f k_i k_w \delta + \omega k_i (0.185 \omega_f k_w + \delta k_i)}{(\omega + \omega_f) (0.185 \omega_f k_i + \delta k_f)}$ |

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COMPUTATION OF BREAKING WAVE LOADS AND FEM MODELING OF A PNEUMATIC WAVE ENERGY CATCHER

Mihail PRICOP¹
Florin GHEORGHE²
Valentin ONCICA³

¹ Cpt.cdor.conf.dr.ing. Mihail Pricop, Naval Academy „Mircea cel Bătrân”, Constanța

² Asp.prep.univ.ing. Florin Gheorghe, Naval Academy „Mircea cel Bătrân”, Constanța

³ Cpt.cdor.șef.lucr.dr.ing. Valentin Oncica, Naval Academy „Mircea cel Bătrân”, Constanța

Abstract: *The purpose of this paper is to show the outcome of our research concerning determining the distribution of wave pressure in the catcher structure, and secondly concerning verifying with FEM the predimensioned structure resistance when hit by the waves in the Black Sea; furthermore the vertical distribution of horizontal and vertical velocity and wave pressure relatively with the catcher position are studied and analyzed, helping us to make a decision over the structural dimensions.*

The wave velocity and pressure have been determined using the Goda method on breaking wave forces on walls. The input data has been considered to be the average multiannual value of wave height and period on the Romanian Black Sea coast; furthermore we have taken into consideration the case of the highest wave from the last fifty years. The catcher geometrical characteristics have been tailored using criteria given by the wave parameters on the Romanian Black Sea coast.

Key words: *wave energy catcher, pulsating wave loads, Goda model, breaking wave forces.*

1. Introduction

The pneumatic wave energy catcher is a component of the electrical microplant (fig.1) and its purpose is to transform the wave mechanical energy into electrical energy; the wave hits the structure, the water seep in a chamber specially designed and compresses the air in the chamber [5]; the air moves a turbine coupling an electrical generator. The process is reversed when water is exiting the chamber.

The chamber has two openings; the first is under the water surface and permits water to seep in; the later permits air circulation and it's placed above the water surface.

The process is based on water level variations in and outside the catcher; these variations dictate the way pressure and volume of air vary through the catcher.

Wave characteristics in the Black Sea

The multiannual wave system, as it was empirical measured and recorded on the SW coast of the Black Sea, is characterised by:

| | |
|--|--------|
| - the maximum significant height | 8.2 m |
| - the average multiannual significant height | 1.03 m |
| - the maximum average period | 9.8 s |
| - the average multiannual period | 3.9 s |

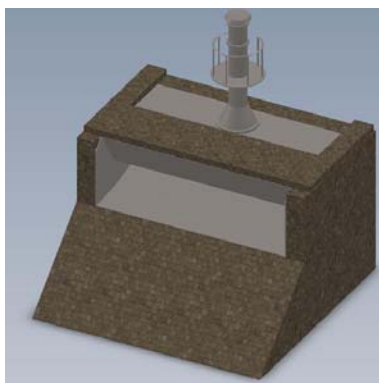


Fig.1 Hydro-pneumatic wave energy catcher microplant

Computations have been made using the average significant wave for the Romanian coast which has the following values:

| | |
|---------------------------------|--------|
| - the average of maximum height | 1.6 m |
| - the average wave period | 4.58 s |

2. Wave force on pneumatic catcher

This chapter describes waves as primary source of energy captured by the microplant. It is interesting to determine the way the microplant would stand in storm; for these computations wave characteristics from Mamaia and Constanța would be used. Estimating wind wave growth and transformation at shore proximity is a major issue on most of coastal engineering projects, design and built of coastal superstructures, navigation conditions, evaluating natural evolution of inlets and beaches.

Wave propagation on the surf zone is influenced by a complex pressure distribution, wind generated currents, water level variations and the existing coastal structures.

At present there are various numerical models to transform surf zone waves [1], [2], [3], [6], [7], useful in practical engineering applications and research. The models are very different using different algorithms, input data and user control on the model.

2.1. Equivalent deepwater significant wave height

The analysis of wave transformation is often facilitated by the concept of equivalent deepwater wave. It is a hypothetical wave devised to account for the effects of refraction, diffraction and bottom friction on the deepwater wave. Using the equivalent significant deepwater wave height to cater for these processes, model tests can be carried out with straight and parallel seabed contours.

The equivalent deepwater significant wave height is related to the deepwater significant wave height as follows and is used in the Goda's method [1], [3] of wave breaking:

$$H'_0 = K_f \cdot K_r \cdot K_d \cdot H_0 \tag{1}$$

Where:

K_f is the coefficient of random wave attenuation due to bottom friction;

K_r is the coefficient of random wave refraction

K_d is the coefficient of random wave diffraction

$H_0 = (H_{1/3})_0$ is the deepwater significant wave height.

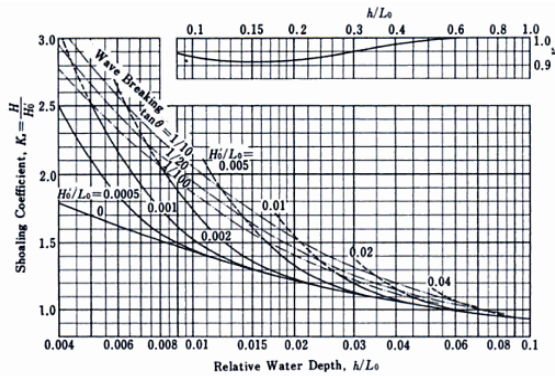


Fig.2 Goda's diagram for determining shoaling coefficient Ks

Figure 2 represents Goda's diagram which helps to determine shoaling coefficient K_s depending on equivalent deepwater steepness (H'_0 / L_0 meaning height over deepwater wavelength), bottom inclination $tg\theta$ and relative water depth h/L_0 .

Deepwater wave length is determined with:

$$L_0 = \frac{gT^2}{2\pi} = 1,56T^2. \tag{2}$$

2.2. Wave height in surf zone

The variation of wave height within the surf zone can be estimated from the following formulae derived by Goda:

If $h/L_0 \geq 0,2$

$$H_{1/3} = K_s H'_0 \tag{3}$$

$$H_{max} = 1,8K_s H'_0 \tag{4}$$

If $h/L_0 < 0,2$

$H_{1/3}$ is minimum of the following:

$$H_{1/3} = \lambda_0 H'_0 + \lambda_1 h, \tag{5}$$

$$H_{1/3} = \lambda_{max} H'_0, \tag{6}$$

$$H_{1/3} = K_s H'_0. \tag{7}$$

H_{max} is minimum of the following:

$$H_{max} = \beta_0 H'_0 + \beta_1 h, \tag{8}$$

$$H_{max} = \beta_{max} H'_0, \tag{9}$$

$$H_{max} = 1,8K_s H'_0. \tag{10}$$

Coefficients λ_0 , λ_1 , λ_{max} , β_0 , β_1 , β_{max} are given by the following expressions:

Coefficients for $H_{1/3}$:

$$\lambda_0 = 0,028 \left(H'_0 / L_0 \right)^{-0,38} \exp(20tg^{1,5}\theta), \tag{11}$$

$$\lambda_1 = 0,52 \exp(4,2 \operatorname{tg} \theta), \quad (12)$$

$$\lambda_{\max} = \max \left\{ 0,92; 0,32 \left(H'_0 / L_0 \right)^{-0,29} \exp(2,4 \operatorname{tg} \theta) \right\} \quad (13)$$

Coefficients for H_{\max} :

$$\beta_0 = 0,052 \left(H'_0 / L_0 \right)^{-0,38} \exp(20 \operatorname{tg} 1,5 \theta) \quad (14)$$

$$\beta_1 = 0,63 \exp(3,8 \operatorname{tg} \theta), \quad (15)$$

$$\beta_{\max} = \max \left\{ 1,65; 0,53 \left(H'_0 / L_0 \right)^{-0,29} \exp(2,4 \operatorname{tg} \theta) \right\}, \quad (16)$$

where θ gives bottom inclination.

2.3. The goda model for pulsating wave forces

Once the wave height and wave period in front of the structure are known, a model is needed to transform wave heights into loads on the structure. In case of pulsating loads, the model proposed by Goda (1985) can be used [3]. The basis of the Goda model is an assumed pressure distribution over the height and width of the caisson.

According to Goda this method is applicable to either breaking or nonbreaking wave conditions. The superposition of quasi-static and dynamic pressure on the structure has a trapezoid distribution both under and above the water surface.

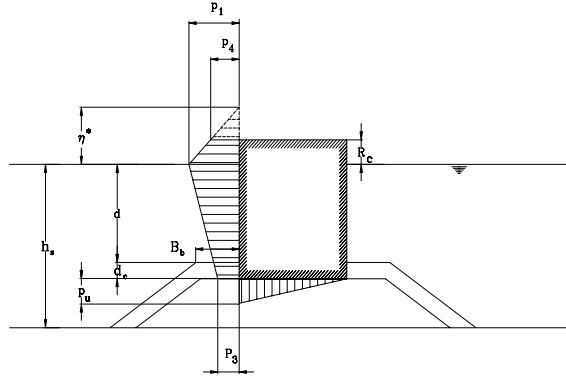


Fig. 3 Pressure distribution according to Goda (1985)

Theoretical wave height η^* and distribution pressures p_1, p_3, p_4, p_u are determined with the following formulae:

$$\eta^* = 0,75(1 + \cos \beta) \lambda_1 H_{\max}, \quad (17)$$

$$p_1 = 0,5(1 + \cos \beta) (\lambda_1 \alpha_1 + \lambda_2 \alpha^* \cos^2 \beta) \rho g H_{\max}, \quad (18)$$

$$p_3 = \alpha_3 p_1, \quad (19)$$

$$p_4 = \alpha_4 p_1, \quad (20)$$

$$p_u = 0,5(1 + \cos \beta) \lambda_3 \alpha_1 \alpha_3 \rho g H_{\max}, \quad (21)$$

In which:

- H : incident wave height in front of the structure;
- β : angle of incidence of the wave attack with respect to a line perpendicular to the structure;
- ρ : density of the water;
- g : acceleration of gravity;
- $\alpha_1, \alpha^*, \alpha_3, \alpha_4$: multiplication factors dependent on the wave conditions and the water depth (see below);
- $\lambda_1, \lambda_2, \lambda_3$: multiplication factors dependent on the geometry of the structure.

The α -factors are given by:

$$\alpha_1 = 0,6 + 0,5 \left(\frac{4\pi h_s / L}{\sinh(4\pi h_s / L)} \right)^2$$

$$\alpha_2 = \min \left(\frac{(1 - d/h)(H/d)^2}{3}, \frac{2d}{H} \right)$$

$$\alpha_3 = 1 - \left(\frac{d + d_c}{h} \right) \left(1 - \frac{1}{\cosh(2\pi h / L)} \right)$$

$$\alpha_4 = 1 - \frac{R_c^*}{\eta^*}$$

In which:

- h_s : water depth in front of the structure;
- L : wave length;
- d : depth in front of the structure;
- d_c : height over which the structure protrudes in the rubble foundation

$$R_c^* = \min(R_c, \eta^*)$$

When the wave pressures are know, the wave forces are given by:

$$F_{h,Goda} = \frac{1}{2}(p_1 + p_3)h' + \frac{1}{2}(p_1 + p_4)R_c^* \tag{22}$$

$$F_{u,Goda} = \frac{1}{2}p_u B.$$

In which B denotes the width of the structure bottom.

The moments of the two wave forces with respect to the rear brim of the structure bottom are given by:

$$M(F_{h,Goda}) = \frac{1}{6}(2p_1 + p_3)h'^2 + \frac{1}{2}(p_1 + p_4)h'R_c^* + \frac{1}{6}(p_1 + 2p_4) \tag{23}$$

$$M(F_{u,Goda}) = \frac{2}{3}F_{u,Goda} B.$$

Under the wave forces $F_{h,Goda}$, $F_{u,Goda}$ and corresponding moments $M(F_{h,Goda})$, $M(F_{u,Goda})$ we have to check the structure stability on horizontal displacement and disturbing moment by the rear brim of the structure bottom

$$S.F. = \frac{\mu(Mgt - F_{u,Goda})}{F_{h,Goda}} \geq 1.2, \tag{24}$$

$$S.F. = \frac{Mgt - M(F_{u,Goda})}{M(F_{h,Goda})} \geq 1.2. \tag{25}$$

Where:

- M - weight structure on the water line
- t - distance between the structure weight centre to the rear brim of the structure bottom,
- μ - friction coefficient between the structure and rock foundation.

3. Simulation using FEM and results

We created the structure using a CAD program. The structure has been predimensioned and mechanical characteristics of materials have been selected.

With notations given in fig.3, let's set the following dimensions for the structure:

$$h=4m, h'=2.5m, d=1.5m, d_c = 1m, R_c = 1m, B=6m, l=5m, tg\theta = 1/100, \beta = 15^\circ.$$

To simulate the catcher structure it is interesting to observe three situations: two loads using the average wave in the Black Sea and the third load using the maximum (highest) wave in the last 50 years which occurred in 1981

$$(H_{max} = 22,08m, T_{max} = 8,3s, L_{max} = 100m).$$

Wave characteristics for the first two loads was calculated and described in table 1:

Tabel 1 Wave characteristics

| Load situation | H_0 [m] | $T_{1/3}$ [s] | L_0 [m] | H_0 / L_0 | h / L_0 | $H_{1/3}$ [m] | H_{max} [m] |
|----------------|--------------|------------------|--------------|-------------|-----------|------------------|------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 10 | 14 |
| Load 1 | 1.03 | 3.9 | 23.7 | 0.043 | 0.168 | 0.94 | 1.7 |
| Load 2 | 1.6 | 4.58 | 32.7 | 0.048 | 0.122 | 1.47 | 2.7 |
| Load 3 | - | 8.3 | 100 | - | 0.04 | - | 22.08 |

In table 2 are shown pressures determined using Goda model for every load:

Tabelul 2 Pressures using Goda model

| Load situation | η^* [m] | α_1 | α_2 | α_3 | α_4 | p_1 [kPa] | p_3 [kPa] | p_4 [kPa] |
|----------------|-----------------|------------|------------|------------|------------|----------------|----------------|----------------|
| 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Load 1 | 2,50 | 0,68 | 0,267 | 0,7 | 0,6 | 15,61 | 10,92 | 9,36 |
| Load 2 | 3,98 | 0,75 | 0,673 | 0,634 | 0,748 | 36,77 | 23,31 | 27,53 |
| Load 3 | 32,44 | 0,95 | 0,136 | 0,918 | 0,969 | 234 | 214,81 | 226,74 |

Forces and moments on catcher structure are determined using pressure and the given relations at paragraph 2. The purpose is to determine the structure weight necessary to ensure a stability coefficient on displacement and disturb at a value of minimum 1.2.

To determine the weight the friction coefficient between structure and foundation is set to 0.6 and the stability coefficient to 1.2; the structure is constructed as shown in picture 3.

Using a finite element method program, the structure has been meshed and it as been determined displacement, strain and stress (fig. 4, 5, 6). Beside the wave load the structure is loaded with the concrete on the structure as shown in the picture ($p=25 \text{ kN/mp}$).

Limit conditions on the structure:

- superior side is free;
- inferior and lateral sides simple railed on the concrete;
- structure legs circular barrels incastrated in concrete.

Each load is analyzed for five water levels: $d=1.5\text{m}$, $d=1.4\text{m}$, $d=1.3\text{m}$, $d=1.6\text{m}$, $d=1.7\text{m}$.

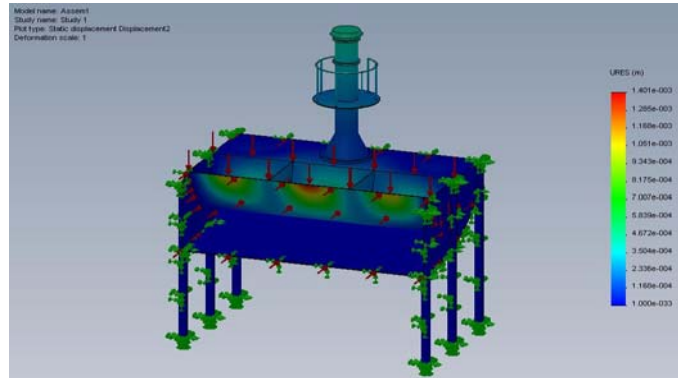


Fig. 4 Displacement, (Load 1, Water level 1.5m)

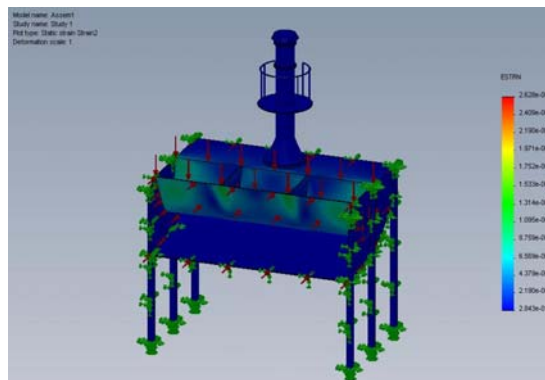


Fig. 5 Strain, (Load 1, Water level 1.5m)

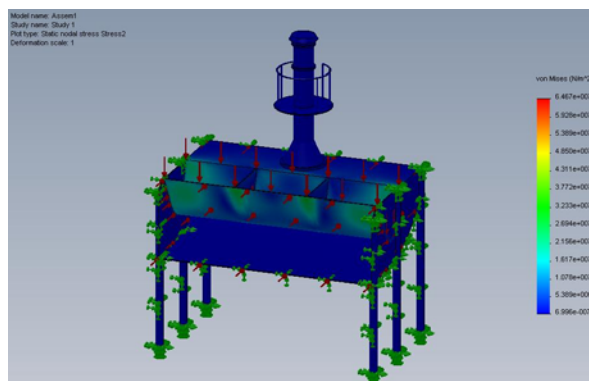


Fig. 6 Stress, (Load 1, Water level 1.5m)

4. Conclusions

After using the FEM program as described above, stress, strain and displacement variations had been determined; the maximum of each can be found in the table below:

Table 3 Maximum values of stress, displacement and strain:

| Outcome Water level d[m] | Stress [MPa] | | | Displacement [mm] | | | Strain | | |
|-----------------------------|--------------|-------------|--------------|-------------------|-------------|-------------|--------------------------------|--------------------------------|--------------------------------|
| | Load 1 | Load 2 | Load 3 | Load 1 | Load 2 | Load 3 | Load 1 [x10 ⁻⁴] | Load 2 [x10 ⁻⁴] | Load 3 [x10 ⁻³] |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1,3 | 64,7 | 43,1 | 363,6 | 1,41 | 0,41 | 13,3 | 2,63 | 1,75 | 1,47 |
| 1,4 | 65,3 | 43,6 | 384,3 | 1,41 | 0,44 | 13,3 | 2,65 | 1,77 | 1,56 |
| 1,5 | 64,6 | 43,8 | 412,5 | 1,40 | 0,48 | 13,3 | 2,62 | 1,78 | 1,67 |
| 1,6 | 64,9 | 44,0 | 439,7 | 1,38 | 0,54 | 13,3 | 2,63 | 1,78 | 1,78 |
| 1,7 | 63,9 | 43,9 | 470,0 | 1,36 | 0,60 | 13,4 | 2,60 | 1,78 | 1,91 |

Being given the result, we can make the following statements:

- in the conditions of wave characteristics in the Black Sea, stress and displacement states are acceptable from the view of elastic resistance and exploiting conditions;
- the water level influence on stress and displacement is insignificant, but it influences more the hydraulic regime of the pneumatic chamber and microplant efficiency;
- the most affected area is the superior part of the chamber where there is a large quantity of concrete which affects stress and displacement; this can be seen comparing stress and displacement in load 2 where the values are smaller than the ones on load 1 (and this is because on second situation the loads are neutralizing each other);
- the stress and displacement on the inferior and lateral sides of the structure are minor due to construction;
- on the third load situation (the highest wave in the last 50 years, $H_{max}=22.08m$), the stress is over the flow limit which is 355 MPa, but is less than the broken limit $R_m=470-630$ MPa of the material; that means the structure would not reach the collapse limit;
- because of the inherent uncertainty due to the dimensions of the structure, the area where the structure will be placed, the foundation system, the loads using Goda model, we consider that the results obtained through simulation should be validated with experimental scale analysis with respect to correction coefficients.

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FEW SOLUTIONS TO REDUCE THE POLLUTION FROM MARINE DIESEL ENGINES

Anastase PRUIU¹
Traian FLOREA²
Alexandru DRAGALINA³
Nicolae BERECHET⁴
Nicu OLAR⁵

¹ Prof.univ.dr.ing. Anastase PRUIU - Academia Navală „Mircea cel Bătrân” Constanța

² Prof.univ.dr.ing. Traian FLOREA - Academia Navală „Mircea cel Bătrân” Constanța

³ Cdor.prof.univ.dr.ing. Alexandru DRAGALINA - Academia Navală „Mircea cel Bătrân” Constanța

⁴ Ing. Nicolae BERECHET - Histria Shipmanagement SRL

⁵ Ing. Nicu OLARU - SNP Petrom S.A. București – Petromar Constanța

Abstract: *The IMO Annex VI of MARPOL 73/78 Regulations for the Prevention of Air Pollution from Ships, has been ratified and took effect from May 2005. In part, Annex VI sets the limits for NOx emissions which will be applicable to ship's propulsion and auxiliary engines greater than 130kW. This regulation affect all new vessels constructed after 1st January 2000. Furthermore, this regulation will also affect engines over 130kW, which undergo major conversion after 1st January 2000. The adoption of this new legislation has far reaching affects for all ship builders and ship operators.*

Keywords: *pollution, engines, fuel*

1. BACKGROUND

Diesel manufacturers and researchers have been investigating a variety of techniques in the hope of reducing diesel emissions as far as reasonably practicable.

These techniques have been divided into three areas of study: pretreatment, primary (internal) methods and secondary (after-treatment) methods.

All these techniques have to some extent been successful in reducing engine emissions however, their effectiveness and the effect they have on the engines themselves may not be completely known or understood. Furthermore, the intended role and purpose of different ships many mean that some techniques may not be adaptable for a given ship design.

It is therefore important to understand what these emissions are, and how they are formed to ensure that by adopting one form of technology to combat NOx will not have a detrimental affect on other emissions which will incur additional costs further down stream.

The most diesel two-stroke engines of today are operating on fuels with sulphur level a higher than 1.5%. Today the average sulphur content of fuel oil used from marine diesel engine is 2,7%.

Annex VI and the Technical Code of MARPOL 73/78 adopted in January 1999 has two significant implications for ship operators. Firstly, it specifies that the sulphur content of fuel oil must not exceed 4.5% m/m (masses report) world wide, or 1.5% m/m for ships operating within SOx Emission Control Areas. Secondly, and perhaps more importantly, it specifies that diesel engines for new ships constructed and for new installations after 1 January 2000, the generation of NOx will be restricted within the following limits:

- 17.0 g/kWh, when the maximum engine speed is less than 130 rpm;
- 45.0xn (-0.2) g/kWh, when the maximum engine speed is more than 130 but less than 2000 rpm;
- 9.8 g/kWh, when the maximum engine speed is greater than 2000 rpm.

In general, the major components in diesel exhaust emission are as shown in next table:

Table 1

| Pollutant | Medium speed engines (g/kWh) | Low speed engines (g/kWh) |
|-----------|---------------------------------|------------------------------|
| NOx | 1.2 | 17 |
| CO | 1.6 | 1.6 |
| HC | 0.5 | 0.5 |
| CO2 | 660 | 660 |
| SO2 | 4.2x%S* | 4.2x%S* |

* S = sulphur content (% m/m).

While the type of fuel used plays a major part in determining the composition of the emissions, the major factor that determines the amount of NOx, is engine speed.

1.1 Sulphur Oxides

The formation of Sulphur Oxides (SOx) in exhaust gases is caused by the oxidation of the sulphur in the fuel into SO2 and SO3 during the combustion process. As indicated in upper table, the amount of SOx formed is a function of the sulphur content of the fuel used and therefore the only effective method of reducing SOx is by reducing the sulphur content of the fuel. Unfortunately, low-sulphur fuels are more expensive to purchase (10 to 20% greater cost, when switching from 3.5% to 1% sulphur) and there is a practical lower sulphur limit desired as desulphurisation of fuel lowers the lubricity of the fuel which can lead to increase wear on fuel pumps and injectors.

The regulation of SOx is predominately a regional issue; however, international pressure is growing for the oil producers to reduce the sulphur content of all fuels in order to control this problem at the source.

Special Areas have been set up, such as the Baltic, where the use of low sulphur fuels is mandatory. If required, desulphurisation of diesel exhaust gases can be achieved by wet scrubbing. The flue gas is first passed through a quencher where it is cooled down to saturation temperature. The SOx is subsequently washed out with a neutralizing agent(calcium bound in lime-milk or seawater) in a scrubber. SOx formed from diesel exhaust is corrosive and in part is neutralized by an engines lubricating oil which is typically base. In the atmosphere however, SOx combines with

moisture to form H₂SO₄, which then falls as acid rain, and has been linked to environmental damage.

1.2 Carbon Dioxide

CO₂ is one of the basic products of combustion and although diesels are one of the most efficient engines for the combustion of fossil fuels, the only way to reduce CO₂ is to either reduce the amount of fuel burned or by increasing thermal efficiency.

1.3. Carbon Monoxide

CO is formed due to the incomplete combustion of organic material where the oxidation process does not have enough time or reactant concentration to occur completely. In diesel engines, the formation of CO is determined by the air/fuel mixture in the combustion chamber and as diesels have a consistently high air to fuel ratio, formation of this toxic gas is minimal.

Nevertheless, insufficient combustion can occur if the fuel droplets in a diesel engine are too large or if insufficient turbulence or swirl is created in the combustion chamber.

1.4. Hydrocarbons

The emission of unburned hydrocarbons (HC) generally results from fuel, which is unburned as a result of insufficient temperature.

This often occurs near the cylinder wall (wall quenching) where the temperature of the air/fuel mixture is significantly less than in the centre of the cylinder. Bulk quenching can also occur as a result of insufficient pressure or temperature within the cylinder itself. Still further, HC production may also be a result of poorly designed fuel injection systems, injector needle bounce, excessive nozzle cavity volumes or fuel jets reaching a quench layer.

1.5. Smoke/Particulates

The composition and properties of diesel particulates varies greatly and is therefore difficult to define. Furthermore, there is not a quantitative relationship between the smoke opacity and the particulate emission. Particle emissions from diesel engines can originate from:

- agglomeration of very small particles of partly burned fuel;
- partly burned lub oil;
- ash content of fuel oil and cylinder lub oil;
- or
- sulphates and water.

The most effect method of reducing particulate emissions is to use lighter distillate fuels however, this leads to added expense. Additional reductions in particulate emissions can be achieved by increasing the fuel injection pressure to ensure that optimum air-fuel mixing is achieved, however, as fuel injection pressure increases, the reliability of the equipment decreases.

1.6. Nitrogen Oxides

While SO_x is predominately a regional issue, NO_x is a global issue and the new MARPOL regulations will have a significant impact for ship owners and ship builders.

NO_x is formed during the combustion process within the burning fuel sprays and is deemed one of the most harmful to the environment and contributes to acidification, formation of ozone, nutrient enrichment and to smog formation, which has become a considerable problem in most major cities world-wide.

The amount of NO_x produced is a function the maximum temperature in the cylinder, oxygen concentrations, and residence time. At cylinder temperatures, nitrogen from the intake air and fuel becomes active with the oxygen in the air forming oxides of nitrogen. Increasing the temperature of combustion increases the amount of NO_x by as much as 3 fold for every 100 °C increase. NO is formed first in the cylinder followed by the formation of NO₂ and N₂O, typically at concentrations of 5% and 1%; respectively. NO₂ is soluble

and washed out by rain which increases the acidity level of the soil.

The best way to reduce NO_x generation, is to reduce peak cylinder temperatures and there are a number of ways that this can be done, however all methods cause a certain loss in engine efficiency which increases the engines sfc..

2. NO_x REDUCTION TECHNOLOGIES

NO_x reduction technologies can be divided into three basic categories namely: pretreatment, internal measures and after-treatment. Pretreatment methods are concentrated on the source of the NO_x, that being the fuel itself.

Internal measure or primary methods alter the engine configuration to, in some form or another, alter the combustion process. After-treatment or secondary methods are fitted externally to the engine and are applied directly to the combustion gases.

Pre-treatment methods generally fall with three categories; denitration of fuel, using alternative fuels and water addition to fuel.

2.1. Alternative fuels

There are at this stage two alternative fuels under investigation for use in diesel engines namely, methanol and liquid petroleum gas (LPG). Methanol has been the subject of much research over the last few years. Methanol does not contain any sulphur and therefore, SO_x from emissions is completely eliminated. Nevertheless, all this does not come without a penalty and the reduction of this penalty has been the focus of the research, which is currently underway.

Methanol has bad ignition qualities and is corrosive in nature. The absence of sulphur means that the lubricity of this fuel is very low. Additionally the use of methanol would require modification to engine injection system. Methanol is a more expensive fuel than distillate and would also incur additional costs in modifications to fuel storage tanks and for the need for leak detection systems. There will also be large scale logistic problems associated with the stowage and the obtaining of this type of fuel in foreign ports.

The use of LPG, on the other hand, is well advanced and in place at many generating power plants. The LPG is also low sulphur and with the use of pilot injection can reduce engine NO_x emissions by 60%. Nevertheless, the major problem of storage on other than LNG ships would constitute a significant problem, which has yet to be overcome. As a conservative industry, ship builders and owners would not want to be compromise or be perceived as compromising safety on board their vessels.

2.2. Water addition to fuels

Emulsion fuel involves adding water to the fuel. Tests have been conducted with up to 30% water in fuel mixture, resulting in a 30% reduction in engine NO_x emissions.

NO_x reduction is achieved by reducing the bulk temperature of combustion. The ultimate affect of adding water to fuel on engine components and lubricating oil is not known but is the subject of continuous research. The use of emulsion fuel would require additional equipment for generating the water/fuel mixture. An additional water tank would be required and may present a problem for smaller ships where water storage is a problem and for those ships where water making facilities are inadequate or not existent.

Primary methods involve changes to the combustion process within the engine:

- modification of combustion;
- modification of scavenge/charging air;
- water injection;
- exhaust gas re-circulation;
- humid air motor.

Each of these categories is discussed below, however there are trade-offs with improving NO_x emissions on other emissions such as particle matter and CO, competitive edge by balancing the reduction of one type of engine emission against another, keeping in mind that fuel economy must not suffer.

2.3. Modification of Combustion

There are a considerable number of ways to modify the combustion process, each with a centered at addressing a particular emissions problem, i.e. reducing NO_x, particulates, or CO. Some of the methods below must be combined in order to realize any particular change in emissions.

Modification of combustion includes:

- injection timing retardation;
- increase in injection pressure;
- modification of Compression ratio;
- optimization of induction swirl;
- modification of injector specification;
- change in number of injectors;
- pre-chamber type of combustion;
- modification of shape of combustion chamber.

2.4. Injection timing retardation

Retarding the injection timing is one of the simplest techniques for reducing NO_x. The effect of injection retardation is to reduce the maximum combustion pressure and hence temperature. By using this simple technique, a reduction of up to 30% can be achieved however, as the engine efficiency is reduced.

Alternatively, rate modulated injection can be used to smooth the cylinder pressure rise by adjusting the rate of the fuel supplied. Typically, this is only effective in medium/high speed diesels at part load. With either of these methods, considerable component redesign (such as camshafts, electronic injection, etc) may be required and are therefore, more suitable to new engine designs.

2.5. Increase of Injection Pressure

Increasing the injection pressure on its own does not have any effect on reducing NO_x, however, is generally combined with other NO_x reduction techniques such as injection retardation. Increasing Injection Pressure leads to better atomization of the fuel and therefore a reduction in Particulates and CO. Since combustion is cleaner, it will tend to be hotter at the kernel as well, which will in fact increase NO_x reduction. Increasing Injection Pressure requires stronger injection equipment and therefore added cost.

2.6. Modification of Compression Ratio

Increasing the compression ratio increases the maximum cylinder pressure and thus cylinder temperature and NO_x. The purpose of increasing the compression ratio would be to overcome some of the efficiency loss due to injection retardation.

2.7. Optimization of Induction Swirl

The optimization of Induction Swirl improves the combustion process and again will not in itself reduce NO_x. The piston crown must be designed for maximum local turbulence but ensure that the turbulence does not impinge on the cylinder walls thereby increasing localized cooling.

2.8. Modification of Injector Specification

Changing the fuel nozzle design has proven to have significant impact on NO_x reduction. Considerable research has been conducted on injector fuel nozzle designs, the effect on nozzle design on emissions generation are better. Recently much attention has been given to mini-sac type nozzles, which have been capable of reducing NO_x by as much as 30%.

2.9. Change in Number of Injectors

There has been some research into increasing the number of injectors per cylinder. Increasing the number of injectors enables the combustion process to be better controlled and therefore more efficient combustion. It has

been reported that a decrease in NO_x from 30% is achievable, however there is a cost penalty associated with the need to have additional injectors, piping and associated equipment. As well as additional equipment, a significant increase in maintenance costs can be expected.

2.10. Modification of Air Intake System

Modification of the Air Intake System can take the form of either the addition of scavenge/charge air cooling or the modification of the scavenge/charge air pressure.

2.11. Scavenge/Charge Air Cooling

Theoretically, providing cooler inlet air can lower the amount of NO_x generated during combustion. Tests have shown that a 14% reduction is possible by lowering the air inlet temperature from 40 °C to 25 °C however, the success of this method is greatly dependent on atmospheric conditions. Furthermore, the scavenge air for low and medium speed engines is already fairly low and therefore, this method would only prove more suitable for high-speed diesels.

2.12. Increasing the Scavenge/Charge Air Pressure

This method would not reduce NO_x if implemented on its own, as an increase in cylinder pressure would result in corresponding increase in cylinder temperature. Combines with other methods such as injection retardation, however, could result in a NO_x reduction of 10 to 40%.

There should be no real affect on engine cost per say if this method was implemented however, as it would need to be combined with other techniques, one would expect the engine cost to be higher.

2.13. Water Injection

Water injection involves adding water directly into the cylinders during combustion through a special injector. As with emulsion fuel, NO_x reduction of up to 40% is achieved by reducing the bulk temperature of combustion but has an advantage in that ignition delay at part load may be avoided.

The limitation for implementing this modification is the capacity of the present fuel system. Separate pumps for the fuel and water are needed along with modifications to the fuel delivery lines and injectors to accommodate a water/fuel ration of 0.8. Potential drawbacks are higher costs and the potential for severe corrosion problems. This technique involves injecting water using the same injector as the fuel.

2.14. Exhaust Gas Re-circulation (EGR)

Exhaust Gas Re-circulation has proven to be successful at reducing NO_x levels due to the higher specific heat capacities of the principal exhaust components (CO₂ and H₂O) in comparison with air. The overall effect is to reduce peak cylinder temperatures. The drawbacks with EGR include increased smoke and particulate levels and increased engine costs. The inserting a particle trap in the exhaust gas recirculation path can reduce smoke and Particulates.

2.15. Humid Air Motor

Humid Air Motor is an alternative to water injection currently being investigated by some diesel engine manufacturers. These motors consist of pumping water (possible sea water) into the engine through the inlet air manifold. Similar reductions in NO_x emissions to water injection can be expected using this technique but the long term effects of using seawater (if used) is not known. Costs are likely to be in the region of direct water injection however, this technique may be retrofitted onto older engines. Secondary methods, or after-treatment, is centered on treating the engine exhaust gas itself either by re-burning the exhaust gas or passing it through a catalyst or plasma system.

There has been much development in **selective catalytic reduction (SCR)** and **non-thermal plasma (NTP)** systems over the last few years. Secondary methods, however, require a step change in capital cost, maintenance and through-life costs over primary methods.

2.16. Re-burning

This technology consists of using fuel as a de-oxidizer into the exhaust system. Fuel is re-introduced into the exhaust gas, which is then re-heated in a boiler but at significant less temperature than the combustion within the diesel itself. Using this method significantly reduces NO_x, however, the thermal efficiency of the cycle is significantly less than the diesel itself. Furthermore, there will be a significant cost and space requirement increase.

2.17. Selective Catalytic Reduction

The SCR method utilizes the fact that NO_x can be converted with ammonia into nitrogen and water in a catalyst. Currently, the most critical problems inherent with this method are the toxicity of the reagent in a marine environment, the investment and operational costs, and the space and weight problems of implementing this solution.

However, the reward is up to a 95% reduction in NO_x. This is the area that is presently receiving an enormous amount of research in order to make this method as practical in all respects as possible and to minimize the amount of ammonia slip experienced during transient responses. Superimposing the numerous primary methods available will not have a significant effect on the total amount of NO_x, which can be eliminated from the exhaust, and doing so will lead to a significant engine cost increase.

2.18. Plasma Reduction Systems

Plasma is a partially ionized gas comprised of a charge of neutral mixture of atoms, molecules, free radicals, ions and electrons. Electrical power is covered into electron energy and the electrons create free radicals, which destruct pollutants in exhaust emissions. The plasma is reactively hot but thermally cool which means that after treatment, little heating, if any, of the exhaust gas results.

For a number of years, AEA Technology has been developing production viable technology for the creation of non-thermal plasma at atmospheric pressure and to date, systems have been developed for incinerator flue gas clean-up, waste solvent treatment, air filtration, UV waste water

treatment. AEA's latest work has been in the development of Non-Thermal Plasma Systems (NTP) for diesel engine exhausts.

The prototype solution for diesel exhaust after-treatment is based on a surface discharge and can be assumed to be an electrically augmented catalyst. The plasma is generated using an alternation high voltage to breakdown the gas between two electrodes. The region between the two electrodes is packed with a material resulting in voltage breakdowns in the voids between the material. The duration of the voltage breakdowns is only of the few nanoseconds. A non-thermal plasma is produced which, augmented by the catalyst, breaks down the exhaust emissions.

Although the NTP System is still in its prototype phase for marine use, production costs should be relatively low cost. The system is compact and extremely flexible in terms of size and shape. Experiments to date have shown that a NO_x reduction of up to 97% is achievable.

3. APPLICATIONS

The new vessels in order to comply with last regulations, the fuel oil drawings are incorporated the special low sulphur content fuel oil storage tank, for engines running in the restricted area.

The fuel oil, before to be burned on the engine, are cleaned in centrifugal separators when the content of the water and impurities are take out. The fuel is kept in the centrifuge as long as possible and normal practice is to have at least two centrifuges available for fuel cleaning. The external fuel oil system of the engine are thermal isolated and pressurized.

In the exhaust duct way of the main engine are fitted a composite boiler witch re-burning the exhaust gases and significantly reduces NO_x emissions. Each engines fitted on board are necessary to have the maker certificate, approved from one classification society, witch attest that engines are full covered regarding IMO annex VI.

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ABOUT FRACTAL MODELLING OF MOUNTAINS WITH RIVERS

Adrian- Gelu RADU¹
Marcel SULTANESCU²

¹ Teacher of Computer Science and Physics, Trades and Services High School, Buzau

² Lecturer of Computer Science, Department of Science Education DPIP Buzau, University Bucuresti

Abstract: Fractality is a mathematical concept which seems to fit some structures in nature. Numerous scientists use derivatives of this concept, and therefore it is bound to happen that the term 'fractal structure' is used in different meanings. It either is used to denote the fractal set itself, or the generating system of the fractal set, where the generating system is based on a suitable construction rule which usually works inductively from one generation level to the next.

This paper addresses the long-standing problem of generating fractal mountains with rivers, and presents a partial solution that incorporates a squig-curve model of a river's course into the midpoint-displacement model for mountains. The method is based on the observation that both models can be expressed by similar context-sensitive rewriting mechanisms. As a result, a mountain landscape with a river can be generated using a single integrated process.

Keywords: terrain models, midpoint displacement, squig curve.

1. Introduction

Fractals have been recognised as a powerful description of many natural objects for several years¹. Their definition is generally based on concepts of dimension which reflect the fragmentation or irregularity feature of these structures. In this work we investigate the definition of fractals by extending geometric descriptions to multiple resolutions. Based on this approach we propose a fractal definition as a composition of exponential functions embedded in a multidimensional domain. By considering transformations between different resolutions we provide a definition of fractals capable of modelling continuous deformations.

The aim of modelling these deformations is to extend fractal descriptions to animated forms. If objects are represented by sets then a geometric mapping can be characterized by a function f which assigns $y \in Y$ for each $x \in X$ in such a way that the geometrical properties of the sets are left intact

$$f : X \rightarrow Y \tag{1}$$

Each geometry is defined by a particular group of mappings which are called a group of motions^[3]. Isometries, for example, are a group of motions which preserve distance between points and they characterise Euclidean geometry.

Affine geometry is defined when transformations of scale are included. Other geometries such as inversive, differential and topology are defined by more complex mappings. Fractal geometry is characterized by a group of motions applied to different resolutions within the same object. That is, equation (1) is represented by

$$f : X_i \rightarrow Y_j \tag{2}$$

where the subindex i and j represent two resolutions of an object X . According to this definition it is possible to apply the mappings of different geometries to create a fractal. In the literature the creation of fractals has been restricted to the use of the mappings of Euclidean and affine geometry^[4]. In this work we propose to extend the mappings to include homeomorphism. These mappings characterise topology which can be defined as the geometry of continuous deformation.

2. Brownian motion in Nature

It was a Scottish botanist Robert Brown who noticed the near random movement of a small particle when it is immersed in a liquid or gas. The liquid or gas is composed of continually moving molecules that hit the small particle from different directions. This movement is now named after him and called *Brownian motion*. A physicist Jean Perrin tried to measure the velocity which is the *derivative* of the particle's position with respect to time, but found that the velocity of the particle "varies in the wildest way in magnitude and direction, and does not tend to a limit as the time taken for an observation decreases" and also said that "nature contains suggestions of non-differentiable as well as differentiable processes".

The following pictures show a computer generated particle being observed at different time intervals. As the time intervals are reduced the calculated length of the path actually increases.

The figure above shows the path of a computer generated particle. At regular time intervals the position of the particle is observed and plotted. The three figures below then show the same path but with the frequency of these observations doubling each time.

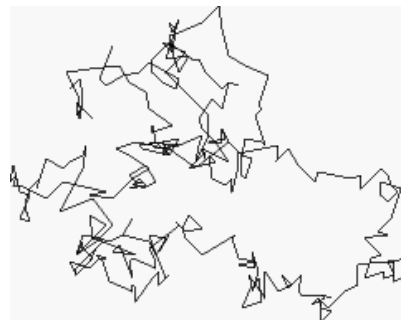


Fig. 1 Length=6392, Step=32



Fig. 3 Length=12091, Step=8

Fig. 2 Length=8747, Step=16

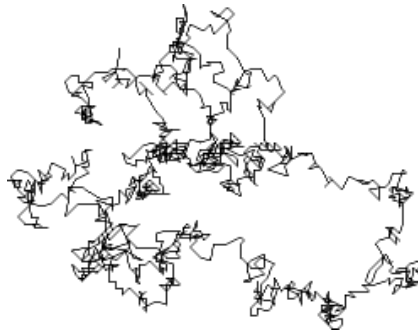


Fig. 4 Length=17453, Step=4

This study of Brownian motion shows us that some processes in nature are best modelled by non-differentiable functions.

These functions will have a length that is infinite.

The term *fractal*, introduced in the mid 1970's by Benoit Mandelbrot, is now commonly used to describe this family of non-differentiable functions that are infinite in length. As you look closer into the curve the apparent length becomes longer and longer. In the extreme this would create an infinitely long line. In reality we reach the tiny level of molecules that are pushing the particle. For those who want to find out more about differentiation and fractals take a look at "The origins of fractals" elsewhere in this Issue.

3. Landscapes - Mandelbrot Surfaces

The above curve is deterministic in that it always looks the same no matter how often it is created. We now add some randomness to the process and use it to create a synthetic mountain landscape.

Start with a grid of four points defining the corners. We now specify four random values that define the heights at these points, and scale the heights by a scaling factor d .

Next we divide this square up into four squares. This will define four new points around the edge of our original square, and also a point in the centre of it. The heights at these five new points are calculated as follows:

For a given 'edge-point' we first calculate the average of the heights of its two neighbouring corners, and then add on a random value. This random value is normally distributed and scaled by a factor d_1 related to the original d by

$$d_1 = \left(\frac{1}{2}\right)^{\frac{H}{2}} \cdot d \tag{3}$$

For the point in the centre we calculate the average of *all four* original corners, and then add on a random value, scaled as above.

We can now carry out exactly the same procedure on each of the four smaller squares, continuing for as long as we like, but where we make the scaling factor at each stage smaller and smaller; by doing this we ensure that as we look closer into the landscape, the 'bumps' in the surface will become smaller, just as for a real landscape. The scaling factor at stage n is d_n , given by

$$d_n = \left(\frac{1}{2}\right)^{n \cdot \frac{H}{2}} \cdot d \tag{4}$$

Finally we achieve a continuous fractal landscape.

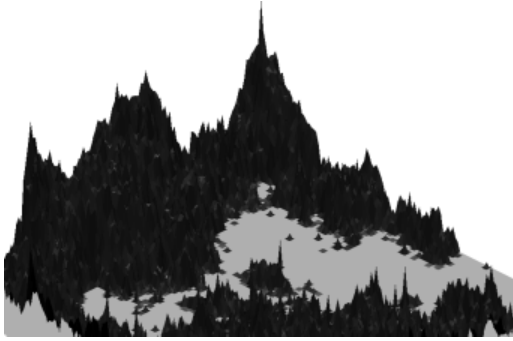


Fig. 5 H=0.50

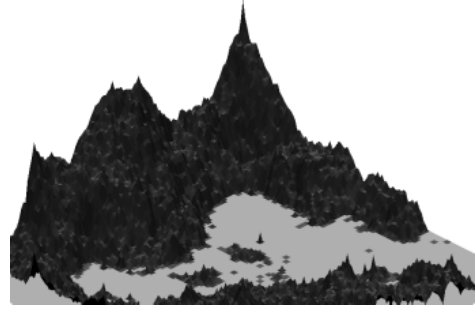


Fig. 6 H=0.75

The value of H used above defines how smooth the resulting landscape is. When H is small the surface is very rough; as H increases the landscape becomes smoother. The following sequence shows what happens as we vary H .

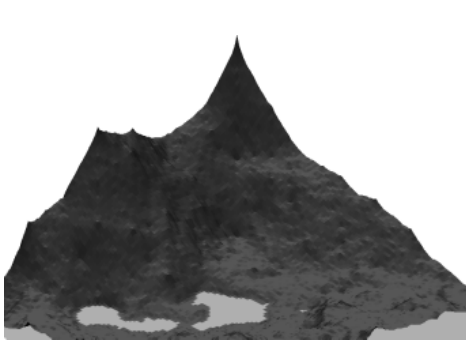


Fig. 8 H=1,25

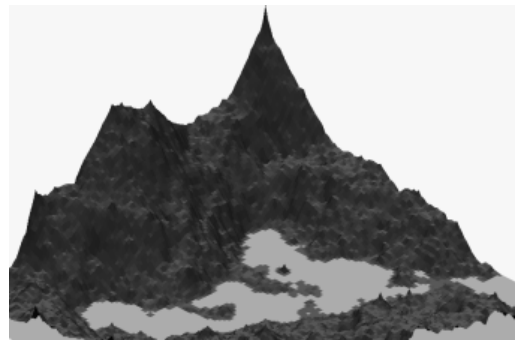


Fig. 7 H=1,00

It turns out that by using different sets of random numbers as a seed many contrasting fractal landscapes of this type can be created, and an infinite set of random numbers can create a landscape of infinite detail.

4. Composition of fractals

The recursive mappings in fractals are characterised by a functional equation which describes a set of transformations applied to an original set. Particular characterizations of this function are the formulation of Iterative Function Systems (IFS)[5] where fractals are created by the recursive use of matrix transformations and grammars applied to descriptions of lines[6]. Dubuc[7] considers an analytic form of a functional equation which defines irregular curves and whose formulation corresponds to a parametric complex-valued function. Here, we extend this definition to a multidimensional parametric space.

This extension allows curves with a self-similar property to be created. We consider the composition of a fractal F as a linear additive combination of functions which describe different resolutions

$$F = \sum_{i=1}^{n \rightarrow \infty} f_i \tag{5}$$

According to equation (2) each function in this equation has a recursive definition. That is

$$f : f_i \rightarrow f_{i+1} \tag{6}$$

Therefore, an object is described by a composite map of the form $f_{i+1} = f \circ f_i$. The function f can be characterized by the motions of any geometry. If f is a homeomorphism (i.e. a continuous one-to-one mapping of the plane onto itself) then the resolutions of an object are related by general mappings.

In order to develop equation (5) by a homeomorphic mapping it is necessary to specify a level of detail f_i using a general function. There exist many potential ways of describing this function, we use a parameterised decomposition based on a series of sinusoids at different frequencies. That is,

$$f_i = \sum_k (a_{ik} \cos(k\theta_i) + b_{ik}(k\theta_i)) \tag{7}$$

where the coefficients a_{ik} and b_{ik} correspond to two orthonormal vectors

$$a_{ik} = a_{x_n} + ja_{y_n}, \quad b_{ik} = b_{x_n} + jb_{y_n} \tag{8}$$

This equation defines a mapping from an i -dimensional space to the complex plane, and it can be proven that it corresponds to the generalisation of the mappings described in affine geometry to functions represented by different frequencies.

5. Examples

The combination of equations (5) and (7) defines a mathematical representation which allows several irregular curves to be created. We have created several fractals by defining the domain of the function as a discrete set of points. As an example, consider the structure defined by only one term in the summation of equation (7) with

$a_{i1} = b_{i1}$, then

$$F = \sum_{i=1}^n a_i e^{j(\theta_i + \rho_i)} \tag{9}$$



Fig. 9: Example of a fractal obtained by a change in phase

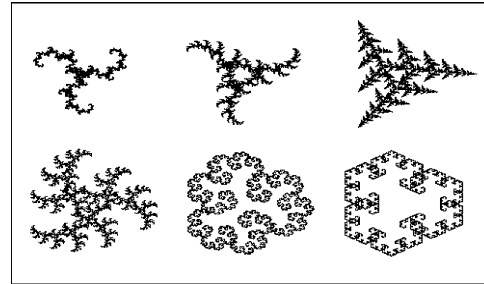


Fig. 10: Sequence of a fractal animation

Figure 9 shows the result of evaluating this function with a domain θ_i specified by $[0.2\pi / 3.4\pi / 3]$ and a recursive definition of the values of a_i and ρ_i given by $a_{i+1} = 3a_i/2$ and $\rho_{i+1} = \rho_i + \pi/2$.

A dynamic fractal can be created by parameterising equation (7) in time. This parameterization corresponds to a function $m(t)$ which describes the deformation of a complete structure in terms of transformations in each resolution. These transformations define a change in a resolution f_i until it occupies the space defined by another function g_i . That is

$$m_i(t) : f_i \rightarrow g_i \tag{10}$$

kind of functions can be formalized mathematically through the mappings defined in topology and they can be used to model continuous deformations of fractals.

Figure 2 shows a sequence of a fractal deformation produced by changing the definition of the phase in each resolution as a function in time. It can be seen from the figure that simple changes can produce a complex dynamic behaviour where one cannot discover the rules of articulation and where geometric patterns emerge forming a fragmented shape.

4. Conclusion

This work we have considered the extension of the patterns defined in fractal geometry to dynamic descriptions.

In the same way in which irregular curves have been applied to the study and modelling of complex forms such as plants, trees, molecular chains, clouds, shells, ice formation or ocean waves^{1, 5, 8}, the extension presented here permits the analysis and synthesis of models for the continuous distortion of complex forms. The extension is developed using a functional representation based on mappings which define levels of detail through geometric transformations. These transformations are parameterised in time to obtain dynamic structures.

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COMPARATIVE ANALYSES AT DIFFERENT TEMPERATURES ON THE BEHAVIOUR OF CYLINDRICAL ENERGY STORING ELASTIC ELEMENTS WITHIN ELECTRICAL EQUIPMENTS

Gheorghe RAȚIU¹

¹ Assoc.prof. dr.eng., “Nicolae Balcescu” Land Forces Academy, Sibiu

Abstract: *There is a tendency for miniaturization in the electrical equipments industry. Due to the miniaturization, electrical stress is increasing, so that deflection may appear. Deflection processes modeling needs complete information. In order to change a determinist design to a operational one, that will take into account the reliability, one needs to know each parameter variation low. In this paper one make a forecast estimation of the helicoidally springs characteristics, by the reliability indicators and by the performance degradation coefficient of the spring metal “b”, that is experimentally measured using some original stand in heating conditions.*

Keywords: *reliability, degradation coefficient, heating conditions*

I. EXPERIMENTAL RESULTS ON THE DEGRADATION COEFFICIENT OF THE ELASTIC CYLINDRICAL SYSTEMS PERFORMANCES IN HEATING CONDITIONS

The conception used in reliability and men tenability of electric equipments accounts for a different, nontraditional strategy. Preliminary dimensioning algorithms are based on defects assessment, stochastic models analysis and using of security operation coefficients. Knowing the physical mechanisms of fatigue is essential in reliability consideration in the conception phase.

Elastic elements of the electric equipments are exposed to fatigue solicitations that are oscillatory cycling, so that their functional characteristics depend on the cycle number and on the temperature. In this way a degradation of performances develops and it is characterized by the degradation coefficient “b”.

In order to get a close-to-reality relationship between the spring force, after N cycles and that obtained when the spring is new (zero cycles) when the length and temperature are fixed, an original thermo stated installation was built and it was mounted on the experimental at environmental temperature stand, given in [1]. A stable temperature of 90°C, 80°C, 70°C and 60°C was maintained. The electric scheme of the thermo stated installation is given in [1].

Measurements were made for cylindrical elements on 4 or 3 spring types, each type being represented by 20 springs for each temperature (90°C, 80°C, 70°C and 60°C). (similar measurements were made as in the case of environmental temperature [1]) Measurements are exemplified in table 1 and 4, for cylindrical elements Measurement tables were made. Each spring type was verified for real repartition of measurements to follow the theoretical normal repartition law, by using Massey concordance test. Values were tabulated and functions $\overline{P}_{N_2} = f(N)$ and $\ln \overline{P}_{N_2} = f(N)$ represented[2]. This is shown, for cylindrical elements in table 2 for 90°C, in table 5 for 80°C, in table 7 for 70°C, and in table 9 for 60°C [3]

Calculation algorithm for b_{1t} , b_{2t} , b_{3t} , b_{4t} degradation coefficients is similar to that for the calculation of b_1 , b_2 , b_3 , b_4 coefficients [1]. For the cylindrical elements, the final table 3 was made for the 3 spring types b_t coefficients, for 90°C., the final table 6 was made for the 4 spring types b_t coefficients, for 80°C. , the final table 8 was made for the 3 spring types b_t coefficients, for 70°C. the final table 10 was made for the 3 spring types b_t coefficients, for 60°C. [4]

Measurements:

Compression cylindrical spring type AC 19

Characteristics: d = 1,8 mm; $\overline{D}_e = 20,8$ mm; $\overline{D}_m = 19$ mm; n = 9,5 spiral; $H_2 = 31$ mm; $f_2 = 20$ mm; RR wire; $\theta_1 = 90^\circ$ C.

Table 1

| No. meas | 0 cycles | | 5·10 ⁵ cycles | | 10 ⁶ cycles | | 2·10 ⁶ cycles | | 3·10 ⁶ cycles | |
|-------------|----------------------|-----------------------|--------------------------|-----------------------|------------------------|-----------------------|--------------------------|-----------------------|--------------------------|-----------------------|
| | H ₀ mm | P ₂ [N] | H ₀ mm | P ₂ [N] | H ₀ mm | P ₂ [N] | H ₀ mm | P ₂ [N] | H ₀ mm | P ₂ [N] |
| 1 | 50 | 31.3 | 48.7 | 30.6 | 47.5 | 29.5 | 45 | 28.8 | 43.1 | 27.3 |
| 2 | 50 | 31.3 | 48.8 | 30.6 | 47.5 | 29.5 | 45 | 29 | 43.1 | 27.3 |
| 3 | 50.2 | 31.5 | 49 | 30.8 | 47.5 | 29.7 | 45 | 29 | 43.3 | 27.3 |
| 4 | 50.2 | 31.7 | 49 | 31 | 47.6 | 30 | 45.1 | 29.2 | 43.3 | 27.7 |
| 5 | 50.4 | 31.7 | 49.2 | 31 | 48 | 30 | 45.4 | 29.2 | 43.4 | 27.7 |
| 6 | 50.5 | 32 | 49.2 | 31.2 | 48 | 30.1 | 45.4 | 29.4 | 43.4 | 28 |
| 7 | 50.5 | 32 | 49.3 | 31.3 | 48 | 30.2 | 45.5 | 29.4 | 43.6 | 28.1 |
| 8 | 50.7 | 32.3 | 49.4 | 31.5 | 48.1 | 30.2 | 45.5 | 29.6 | 43.6 | 28.1 |
| 9 | 50.7 | 32.3 | 49.4 | 31.5 | 48.2 | 30.2 | 45.6 | 29.6 | 43.8 | 28.3 |
| 10 | 50.7 | 32.4 | 49.5 | 32 | 48.2 | 30.7 | 45.6 | 30 | 43.8 | 28.5 |
| 11 | 50.9 | 32.5 | 49.5 | 32 | 48.4 | 30.7 | 45.7 | 30 | 43.8 | 28.7 |
| 12 | 51 | 32.7 | 49.8 | 32.2 | 48.4 | 31.2 | 45.7 | 30.5 | 43.9 | 29 |
| 13 | 51 | 32.7 | 49.8 | 32.2 | 48.7 | 31.2 | 45.8 | 30.5 | 43.9 | 29.2 |
| 14 | 51.2 | 33 | 50 | 32.3 | 48.8 | 31.3 | 46 | 30.6 | 44.1 | 29.2 |
| 15 | 51.2 | 33 | 50 | 32.3 | 48.9 | 31.3 | 46.2 | 30.8 | 44.2 | 29.3 |

| No. meas | 0 cycles | | 5·10 ⁵ cycles | | 10 ⁶ cycles | | 2·10 ⁶ cycles | | 3·10 ⁶ cycles | |
|----------------|-------------------|--------------------|--------------------------|--------------------|------------------------|--------------------|--------------------------|--------------------|--------------------------|--------------------|
| | H ₀ mm | P ₂ [N] | H ₀ mm | P ₂ [N] | H ₀ mm | P ₂ [N] | H ₀ mm | P ₂ [N] | H ₀ mm | P ₂ [N] |
| 16 | 51.3 | 33.2 | 50.2 | 32.6 | 48.9 | 31.5 | 46.2 | 30.8 | 44.2 | 29.4 |
| 17 | 51.5 | 33.2 | 50.2 | 32.6 | 49 | 31.5 | 46.4 | 31 | 44.4 | 29.7 |
| 18 | 51.6 | 33.4 | 50.4 | 32.8 | 49 | 31.8 | 46.4 | 31 | 44.4 | 29.7 |
| 19 | 51.7 | 33.5 | 50.6 | 33 | 49.3 | 32 | 46.7 | 31.3 | 44.8 | 30 |
| 20 | 51.8 | 34 | 50.7 | 33.1 | 49.3 | 32.2 | 46.7 | 31.5 | 44.8 | 30.1 |
| H ₀ | 50.9 | | 49.6 | | 48.3 | | 45.7 | | 43.8 | |
| P ₂ | | 32.45 | | 31.55 | | 30.9 | | 29.7 | | 28.5 |

P_{2 calc} (0 cycles) = 32.1 N

Table 2: Compression helicoidally spring A.C. 11, θ_i = 90°C

| N (cycles) | 0 | 5·10 ⁵ | 10 ⁶ | 2·10 ⁶ | 2,5·10 ⁶ | 3·10 ⁶ |
|-----------------|-------|-------------------|-----------------|-------------------|---------------------|-------------------|
| \bar{P}_2 (N) | 62.02 | 60.21 | 58.74 | 57.07 | 55.93 | 54.91 |
| $\ln \bar{P}_2$ | 4.127 | 4.098 | 4.073 | 4.044 | 4.024 | 4.006 |

Table 3: Comparison of coefficient “b”

| No. | Spring type | Semi logarithmic scale | | Normal scale | | Obs. |
|-----|-------------|------------------------|-----------------------|-----------------------|-----------------------|-----------|
| | | b _{1ti} | b _{2ti} | b _{3ti} | b _{4ti} | |
| 1 | AC 11 | 5.40·10 ⁻⁸ | 3.73·10 ⁻⁸ | 3.28·10 ⁻⁷ | 2.12·10 ⁻⁷ | θ = 90° C |
| 2 | AC 12 | 5.10·10 ⁻⁸ | 3.60·10 ⁻⁸ | 0.82·10 ⁻⁶ | 0.53·10 ⁻⁶ | θ = 90° C |
| 3 | AC 19 | 5.30·10 ⁻⁸ | 4.06·10 ⁻⁸ | 1.69·10 ⁻⁶ | 1.22·10 ⁻⁶ | θ = 90° C |

MEASUREMENTS:

Compression cylindrical spring type AC 19

Characteristics: d = 1,8 mm; D_e = 20,8 mm; D_m = 19 mm; n_t = 11 spiral; n = 9,5 spiral; H₂ = 31 mm; f₂ = 20 mm; RR wire; θ_i = 80° C.

Table 4

| No. meas | 0 cicli | | 5·10 ⁵ cycles | | 10 ⁶ cycles | | 2·10 ⁶ cycles | | 3·10 ⁶ cycles | |
|----------|-------------------|--------------------|--------------------------|--------------------|------------------------|--------------------|--------------------------|--------------------|--------------------------|--------------------|
| | H ₀ mm | P ₂ [N] | H ₀ mm | P ₂ [N] | H ₀ mm | P ₂ [N] | H ₀ mm | P ₂ [N] | H ₀ mm | P ₂ [N] |
| 1 | 50 | 31.6 | 48.7 | 30.6 | 47.5 | 29.8 | 45 | 28.8 | 43.1 | 27.6 |
| 2 | 50 | 31.6 | 48.8 | 30.6 | 47.5 | 29.8 | 45 | 29 | 43.1 | 27.7 |
| 3 | 50.2 | 31.8 | 49 | 30.8 | 47.5 | 30 | 45 | 29 | 43.3 | 27.7 |
| 4 | 50.2 | 32 | 49 | 31 | 47.6 | 30.2 | 45.1 | 29.2 | 43.3 | 28 |
| 5 | 50.4 | 32 | 49.2 | 31 | 48 | 30.2 | 45.4 | 29.2 | 43.4 | 28 |
| 6 | 50.5 | 32.2 | 49.2 | 31.2 | 48 | 30.4 | 45.4 | 29.4 | 43.4 | 28.2 |
| 7 | 50.5 | 32.3 | 49.3 | 31.3 | 48 | 30.5 | 45.5 | 29.4 | 43.6 | 28.4 |
| 8 | 50.7 | 32.5 | 49.4 | 31.5 | 48.1 | 30.5 | 45.5 | 29.6 | 43.6 | 28.4 |
| 9 | 50.7 | 32.5 | 49.4 | 31.5 | 48.2 | 30.5 | 45.6 | 29.6 | 43.8 | 28.6 |
| 10 | 50.7 | 32.7 | 49.5 | 32 | 48.2 | 31 | 45.6 | 30 | 43.8 | 28.8 |
| 11 | 50.9 | 32.8 | 49.5 | 32 | 48.4 | 31 | 45.7 | 30 | 43.8 | 29 |
| 12 | 51 | 33 | 49.8 | 32.2 | 48.4 | 31.5 | 45.7 | 30.5 | 43.9 | 29.2 |
| 13 | 51 | 33 | 49.8 | 32.2 | 48.7 | 31.5 | 45.8 | 30.5 | 43.9 | 29.5 |
| 14 | 51.2 | 33.2 | 50 | 32.3 | 48.8 | 31.6 | 46 | 30.6 | 44.1 | 29.5 |
| 15 | 51.2 | 33.3 | 50 | 32.3 | 48.9 | 31.6 | 46.2 | 30.8 | 44.2 | 29.6 |
| 16 | 51.3 | 33.5 | 50.2 | 32.6 | 48.9 | 31.8 | 46.2 | 30.8 | 44.2 | 29.7 |
| 17 | 51.5 | 33.5 | 50.2 | 32.6 | 49 | 31.8 | 46.4 | 31 | 44.4 | 30 |
| 18 | 51.6 | 33.7 | 50.4 | 32.8 | 49 | 32.1 | 46.4 | 31 | 44.4 | 30 |

| No. meas | 0 cicl | | 5·10 ⁵ cycles | | 10 ⁶ cycles | | 2·10 ⁶ cycles | | 3·10 ⁶ cycles | |
|-------------|-------------------|--------------------|--------------------------|--------------------|------------------------|--------------------|--------------------------|--------------------|--------------------------|--------------------|
| | H ₀ mm | P ₂ [N] | H ₀ mm | P ₂ [N] | H ₀ mm | P ₂ [N] | H ₀ mm | P ₂ [N] | H ₀ mm | P ₂ [N] |
| 19 | 51.7 | 33.8 | 50.6 | 33 | 49.3 | 32.3 | 46.7 | 31.3 | 44.8 | 30.2 |
| 20 | 51.8 | 34.1 | 50.7 | 33.1 | 49.3 | 32,5 | 46.7 | 31.5 | 44.8 | 30.4 |
| \bar{H}_0 | 50.86 | | 49.6 | | 48.3 | | 45.7 | | 43.8 | |
| \bar{P}_2 | | 32.76 | | 31.83 | | 31.07 | | 30.06 | | 28.9 |

$P_{2 \text{ calc}} (0 \text{ cycles}) = 32,7 \text{ N}$

Table 5: Compression helicoidally spring A.C. 11, $\theta_i = 80^\circ\text{C}$

| N (cycles) | 0 | 5·10 ⁵ | 10 ⁶ | 2·10 ⁶ | 2,5·10 ⁶ | 3·10 ⁶ |
|-----------------|-------|-------------------|-----------------|-------------------|---------------------|-------------------|
| \bar{P}_2 (N) | 62.02 | 60.21 | 58.74 | 57.07 | 55.93 | 54.91 |
| $\ln \bar{P}_2$ | 4.127 | 4.098 | 4.073 | 4.044 | 4.024 | 4.006 |

– For curve 1 – semi logarithmic scale

$$\text{tg } \alpha = b_{1t} = \frac{\ln \bar{P}_{02} - \ln \bar{P}_{10^6}}{10^6} = \frac{4,127 - 4,073}{10^6} = \frac{0,054}{10^6} = 5,4 \cdot 10^{-8}$$

$$b_{1t} = \frac{\ln \bar{P}_{02} - \ln \bar{P}_{N_2}}{N}$$

$$\bar{P}_{02} = \bar{P}_{N_2} e^{b_{1t} \cdot N}; \quad b_{1t} = 5,4 \cdot 10^{-8}; \quad \text{for } N \leq 10^6 \text{ cycles}$$

– For curve 2 – semi logarithmic scale

$$\text{tg } \beta = b_{2t} = \frac{\ln \bar{P}_{1,5 \cdot 10^6} - \ln \bar{P}_{3 \cdot 10^6}}{1,5 \cdot 10^6} = \frac{4,062 - 4,006}{1,5 \cdot 10^6} = 3,73 \cdot 10^{-8}$$

$$\bar{P}_{02} = \bar{P}_{N_2} e^{b_{2t} \cdot N}; \quad b_{2t} = 3,73 \cdot 10^{-8}; \quad \text{for } N > 10^6 \text{ cycles}$$

– For curve 3 – normal scale

$$\text{tg } \gamma = b_{3t} = \frac{\bar{P}_{02} - \bar{P}_{10^6}}{10^6} = \frac{62,02 - 58,74}{10^6} = 3,28 \cdot 10^{-6}$$

$$b_{3t} = \frac{\bar{P}_{02} - \bar{P}_{N_2}}{N};$$

$$\bar{P}_{02} = \bar{P}_{N_2} + b_{3t} \cdot N; \quad b_{3t} = 3,28 \cdot 10^{-6}; \quad \text{for } N \leq 10^6 \text{ cycles}$$

– For curve 4 – normal scale

$$\text{tg } \delta = b_{4t} = \frac{\bar{P}_{1,5 \cdot 10^6} - \bar{P}_{3 \cdot 10^6}}{1,5 \cdot 10^6} = \frac{58,10 - 54,91}{1,5 \cdot 10^6} = 2,12 \cdot 10^{-6}$$

$$\bar{P}_{02} = \bar{P}_{N_2} + b_{4t} \cdot N; \quad b_{4t} = 2,12 \cdot 10^{-6}; \quad \text{for } N > 10^6 \text{ cycles}$$

Table 6: Comparison of coefficient “b”

| No. | Spring type | Semi logarithmic scale | | Normal scale | | Obs. |
|-----|-------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------------|
| | | b _{1ti} | b _{2ti} | b _{3ti} | b _{4ti} | |
| 1 | AC 11 | 5.40·10 ⁻⁸ | 3.73·10 ⁻⁸ | 3.28·10 ⁻⁷ | 2.12·10 ⁻⁷ | $\theta = 80^\circ\text{C}$ |
| 2 | AC 12 | 5.10·10 ⁻⁸ | 3.60·10 ⁻⁸ | 0.82·10 ⁻⁶ | 0.53·10 ⁻⁶ | $\theta = 80^\circ\text{C}$ |
| 3 | AC 19 | 5.30·10 ⁻⁸ | 4.06·10 ⁻⁸ | 1.69·10 ⁻⁶ | 1.22·10 ⁻⁶ | $\theta = 80^\circ\text{C}$ |
| 4 | AC 20 | 5.10·10 ⁻⁸ | 3.80·10 ⁻⁸ | 1.05·10 ⁻⁶ | 0.73·10 ⁻⁶ | $\theta = 80^\circ\text{C}$ |

Table 7: Compression helicoidally spring A.C. 11, $\theta_i = 70^\circ\text{C}$

| N _c (cycles) | 0 | 5·10 ⁵ | 10 ⁶ | 2·10 ⁶ | 2,5·10 ⁶ | 3·10 ⁶ |
|-------------------------|-------|-------------------|-----------------|-------------------|---------------------|-------------------|
| \bar{P}_2 (N) | 62.02 | 58.40 | 56.98 | 55.36 | 54.25 | 53.26 |
| $\ln \bar{P}_2$ | 4.127 | 4.067 | 4.028 | 4.014 | 3.994 | 3.975 |

Table 8: Comparison of coefficient “b”

| No | Spring type | Semi logarithmic scale | | Normal scale | | Obs. |
|----|-------------|------------------------|----------------------|----------------------|----------------------|-----------------------------|
| | | b_{1fi} | b_{2fi} | b_{3fi} | b_{4fi} | |
| 1 | AC 11 | $5.2 \cdot 10^{-8}$ | $3.56 \cdot 10^{-8}$ | $3.14 \cdot 10^{-7}$ | $2.06 \cdot 10^{-7}$ | $\theta = 70^\circ\text{C}$ |
| 2 | AC 12 | $4.91 \cdot 10^{-8}$ | $3.40 \cdot 10^{-8}$ | $0.79 \cdot 10^{-6}$ | $0.51 \cdot 10^{-6}$ | $\theta = 70^\circ\text{C}$ |
| 3 | AC 20 | $4.88 \cdot 10^{-8}$ | $3.57 \cdot 10^{-8}$ | $1.01 \cdot 10^{-6}$ | $0.70 \cdot 10^{-6}$ | $\theta = 70^\circ\text{C}$ |

Table 9: Compression helicoidally spring A.C. 11, $\theta_i = 60^\circ\text{C}$

| N_c (cycles) | 0 | $5 \cdot 10^5$ | 10^6 | $2 \cdot 10^6$ | $2,5 \cdot 10^6$ | $3 \cdot 10^6$ |
|-----------------|-------|----------------|--------|----------------|------------------|----------------|
| \bar{P}_2 (N) | 62.02 | 58.40 | 56.98 | 55.36 | 54.25 | 53.26 |
| $\ln \bar{P}_2$ | 4.127 | 4.067 | 4.028 | 4.014 | 3.994 | 3.975 |

Table 10: Comparison of coefficient “b”

| No. | Spring type | Semi logarithmic scale | | Normal scale | | Obs. |
|-----|-------------|------------------------|----------------------|----------------------|----------------------|-----------------------------|
| | | b_{1fi} | b_{2fi} | b_{3fi} | b_{4fi} | |
| 1 | AC 11 | $5.24 \cdot 10^{-8}$ | $3.62 \cdot 10^{-8}$ | $3.14 \cdot 10^{-7}$ | $2.06 \cdot 10^{-7}$ | $\theta = 60^\circ\text{C}$ |
| 2 | AC 12 | $4.95 \cdot 10^{-8}$ | $3.48 \cdot 10^{-8}$ | $0.79 \cdot 10^{-6}$ | $0.51 \cdot 10^{-6}$ | $\theta = 60^\circ\text{C}$ |
| 3 | AC 20 | $4.94 \cdot 10^{-8}$ | $3.65 \cdot 10^{-8}$ | $1.01 \cdot 10^{-6}$ | $0.70 \cdot 10^{-6}$ | $\theta = 60^\circ\text{C}$ |

Observations

a) Experiments were exclusively made on compression helicoidally, cylindrical springs that are part of the electric commutation devices made at „Electroaparataj”, București, executed from RR wires, with a maximum wire diameter of 2 mm and a minimum wire diameter of 0.55 mm. Maximum measured force was of 131 N and the minimum force was of 1.18 N.

b) The thermo stated installation gave the temperature of 90°C 80°C , 70°C and of 60°C these were the temperatures where measurements in heating conditions were made.

c) The b_{1fi} coefficients and b_{2fi} respectively have close values of each “b” coefficient type, so a mean value of each coefficient (b_{1t} , b_{2t}) may be used.

-For $\theta = 90^\circ\text{C}$:

$$\bar{P}_{N2} = \bar{P}_{02} \cdot e^{-b_{1t} \cdot N}, b_{1t} = \frac{\sum_{i=1}^3 b_{1fi}}{3} = 5,26 \cdot 10^{-8} \quad \text{pt. } N \leq 10^6 \text{ cycles.}$$

$$\bar{P}_{N2} = \bar{P}_{02} \cdot e^{-b_{2t} \cdot N}; b_{2t} = \frac{\sum_{i=1}^3 b_{2fi}}{3} = 3,80 \cdot 10^{-8} \quad \text{pt. } N > 10^6 \text{ cycles.}$$

$$b_{1t}, b_{2t} = [\text{cycles}^{-1}]$$

-For $\theta = 80^\circ\text{C}$:

$$\bar{P}_{N2} = \bar{P}_{02} \cdot e^{-b_{1t} \cdot N}, b_{1t} = \frac{\sum_{i=1}^4 b_{1fi}}{4} = 5,22 \cdot 10^{-8} \quad \text{pt. } N \leq 10^6 \text{ cycles.}$$

$$\bar{P}_{N2} = \bar{P}_{02} \cdot e^{-b_{2t} \cdot N}; b_{2t} = \frac{\sum_{i=1}^4 b_{2fi}}{4} = 3,76 \cdot 10^{-8} \quad \text{pt. } N > 10^6 \text{ cycles.}$$

$$b_{1t}, b_{2t} = [\text{cycles}^{-1}]$$

-For $\theta = 70^\circ\text{C}$:

$$\bar{P}_{N2} = \bar{P}_{02} \cdot e^{-b_{1t} \cdot N}; b_{1t} = \frac{\sum_{i=1}^4 b_{1fi}}{4} = 5,04 \cdot 10^{-8} \quad \text{pt. } N \leq 10^6 \text{ cycles}$$

$$\bar{P}_{N2} = \bar{P}_{02} \cdot e^{-b_{2t} \cdot N}; b_{2t} = \frac{\sum_{i=1}^3 b_{2fi}}{3} = 3,58 \cdot 10^{-8} \quad \text{pt. } N > 10^6 \text{ cycles}$$

$$b_{1t}, b_{2t} = [\text{cycles}^{-1}]$$

-For $\theta = 60^\circ\text{C}$:

$$\bar{P}_{N2} = \bar{P}_{02} \cdot e^{-b_{1t} \cdot N}; b_{1t} = \frac{\sum_{i=1}^3 b_{1fi}}{4} = 5,00 \cdot 10^{-8} \quad \text{pt. } N \leq 10^6 \text{ cycles}$$

$$\bar{P}_{N2} = \bar{P}_{02} \cdot e^{-b_{2t} \cdot N}; b_{2t} = \frac{\sum_{i=1}^3 b_{2fi}}{4} = 3,51 \cdot 10^{-8} \quad \text{pt. } N > 10^6 \text{ cycles}$$

$b_{1t}, b_{2t} = [\text{cycles}^{-1}]$

d) The coefficients b_{3ti}, b_{4ti} have dispersed values, so it was not significant to use a mean value in this case.

e) By analyzing functions $\overline{P}_{N_2} = f(N)$ one notes that the function variation can be considered as linear.

Taking into account previous results we proposed the hypothesis of linear degradation of spring performances.

f) The b_{1ti} coefficients and b_{2ti} respectively have close values of each b coefficient type, for $\theta = 90^\circ \text{ C}$. and also for $\theta = 80^\circ \text{ C}$, so a mean value of each coefficient (b_{1t}, b_{2t}) may be used, $5.24 \cdot 10^{-8}$, for $N < 10^6$ cycles and $3.78 \cdot 10^{-8}$ for $N > 10^6$ cycles.

g) The b_{1ti} coefficients and b_{2ti} respectively have close values of each b coefficient type, for $\theta = 70^\circ \text{ C}$. and also for $\theta = 60^\circ \text{ C}$, so a mean value of each coefficient (b_{1t}, b_{2t}) may be used, $5.02 \cdot 10^{-8}$, for $N < 10^6$ cycles and $3.55 \cdot 10^{-8}$ for $N > 10^6$ cycles.

II. Conclusions

Taking into account such a behavior and imposing a certain degree of reliability to devices and components, one can establish the force value so as the device to properly function N cycles at some specified temperature. By such an approach we might change the determinist design fashion by an operational design that should take into account the reliability indicators.

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UNDERWATER ROBOTS MOVEMENT CONTROL ACCORDING TO „TIME” PARAMETER

Simona RUS¹
 Ana ION²
 Victor Octavian RUS³

¹ Ph.D. Eng. Main Scientific Researcher II, Diving Centre, Constanta, Romania;
² Ph.D., "Mircea cel Bătrân" Naval Academy of Constanta, Romania
³ Student, Mechanics Faculty of the "Ovidius" University of Constanta, Romania

Abstract: The measurements that influence an underwater robot's horizontal, vertical, or both directions simultaneous movements are various and have unknown values. The determination of coefficients is difficult and pertains numerous experiments. In conclusion, one may state that there is no other complete mathematical models for such kinds of vehicles, but partial ones. Modeling and simulation of some real underwater vehicles, is practically impossible.

When the mathematical equations of the model are highly approximated - big faults can appear, and they are multi-parametrical when they are very complex – the mathematical model becomes incompatibly undetermined. Modeling according to the method of similitude implies determination of „interest” proportions on miniature models (made at a certain scale), which keep to the rules of similitude. The proportions determined on a model can be extended, with acceptable error for the approved proportions of real underwater robots, which develop in their natural environment.

Keywords: Diving Centre, ROV / AUV, divers, base ship, offshore zone, oil rig.

1. Introduction

Modeling and simulation of some real underwater vehicles, is practically impossible.

When the mathematical equations of the model are highly approximated - big faults can appear, and they are multi-parametrical when they are very complex – the mathematical model becomes incompatibly undetermined.

The measurements that influence an underwater robot's horizontal, vertical, or both directions simultaneous movements are various and have unknown values. The determination of coefficients is difficult and pertains numerous experiments. In conclusion, one may state that there is no other complete mathematical model for such kinds of vehicles, but partial ones. In order to show how an underwater robot behaves, we can use the two systems of axes of coordinates taken independently and in reciprocal relation: the basic or fixed ($O_0x_0y_0z_0$) system of axes of coordinates. In the present case the basic system is related to the ship that transports and launches the underwater robot, which ship is anchored in a certain place or can have a certain place on land or in space (according to the approach or the place where the controlled missions take place) and the mobile system of axes of coordinates ($Oxyz$) attached to the underwater robot (fig. 1).

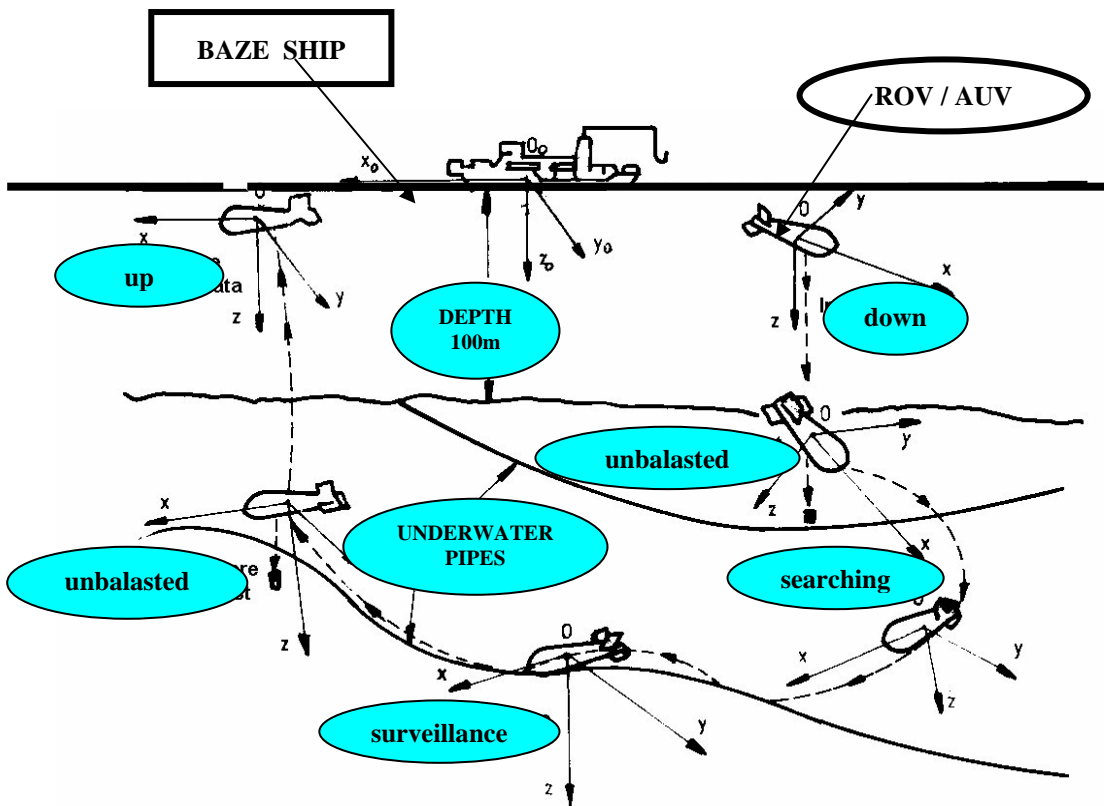


Figure 1. Options concerning the RSA trajectory in relation to the base ship

2. Simulation of the studied phenomenon

After getting to the target zone, the robot finds its place, after a while, at somehow known distances, both horizontally and vertically. After this only the horizontal movement (on one axis) will be taken into consideration, as well as the speed and force (which are to be determined through modeling) which will become known.

Knowing the speeds and forces, by the activation of propulsion in programmable (incremental) times, the necessary displacements will be obtained. A similar model, specific for the controlled impulses modeling method is thoroughly implemented by automatic regulation systems, in different domains.

The mathematical pattern of underwater robot movement is based on the theory of similitude of the phenomenon studied in laboratory with the one that taking place in natural environment, which is very general and close to reality.

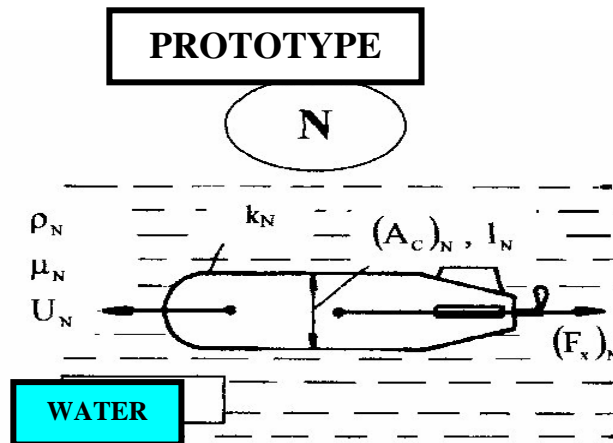


Figure 2. The real / natural phenomenon “N” with the determined homologous dimensions specific to the method of similitude (real underwater robots, which develop in their natural environment)

Modeling according to the method of similitude implies determination of calculating („interest”) proportions on miniature models (made at a certain scale), which keep to the rules of similitude.

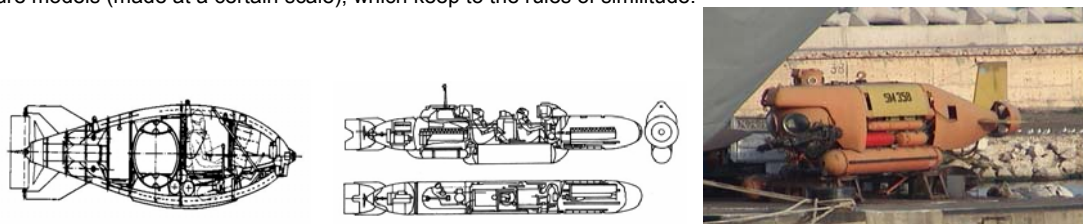


Figure 3. The real forms of three underwater vehicles - RSA, VSA and SM 358 of the “Antipa” Ship

The proportions determined on a model can be extended, with acceptable error for the approved proportions of real underwater robots, which develop in their natural environment.

Based on modeling according to the method of similitude in an aerodynamic tunnel, we shall try to determine, experimentally (fig. 4), according to the model, the coefficients of advance resistance C_x of three real / natural, underwater vehicles, as follow: autonomous underwater vehicle (VSA), the self – propelled underwater vehicle (RSA), and the diver-carrying submersible (SM 358) (fig.3), through research on their respective models, built according to a pre-established scale.

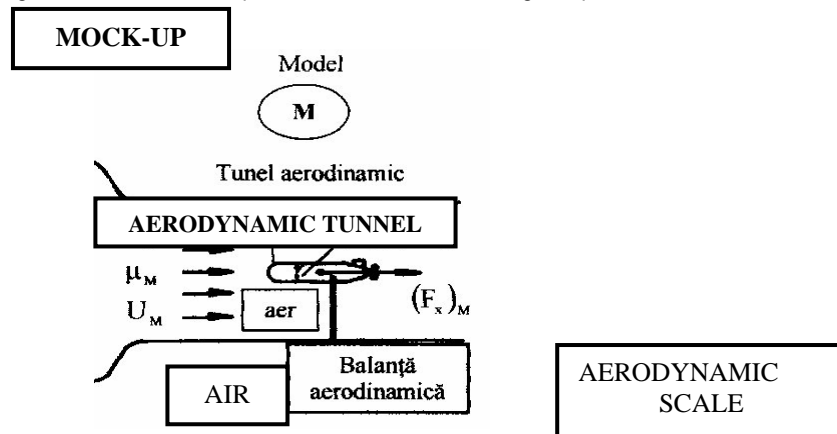


Figure 4. Model phenomenon “ M ” – fixed mock-up in Aerodynamic Tunnel and the determined homologous dimensions specific to the method of similitude

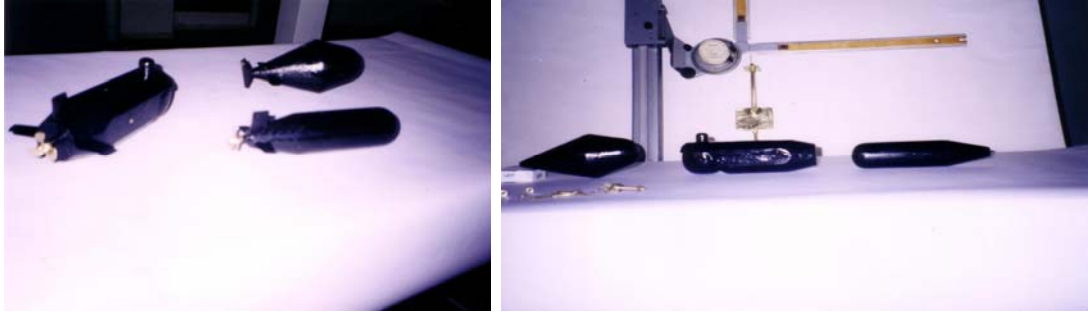


Figure 5. The models for the three submarines (RSA, SM 358 and VSA) with and without empennage and propulsion

3. Determination of the similitude conditions by the „Method of Force”

The similitude between the model phenomenon (M) and the prototype (N) implies the following:

- geometrical similitude, which supposes a scale of lengths “S_{lc}”

$$S_{lc} = \frac{l_{cM}}{l_{cN}} \tag{1}$$

- cinematic similitude, which supposes a scale of lengths “S_{lc}” and a scale of speeds “S_U”;

$$S_{lc} = \frac{l_{cM}}{l_{cN}} \tag{2}$$

$$S_U = \frac{U_M}{U_N} \tag{3}$$

- the dynamic similitude, which supposes a unique scale for the determinant forces that come up during the phenomenon of movement of a solid body in a liquid. These forces are: momentum forces F_i, viscosity forces F_v, and pressure forces F_p. Now, the relation between the forces scale can be written:

$$S_{F_i} = S_{F_v} = S_{F_p} \tag{4}$$

Scale of the inertial forces:

$$S_{F_i} = \frac{(F_i)_M}{(F_i)_N} = \frac{(m \cdot a)_M}{(m \cdot a)_N} = \frac{(\rho \cdot l_c^2 \cdot U^2)_M}{(\rho \cdot l_c^2 \cdot U^2)_N} = S_\rho \cdot S_{lc}^2 \cdot S_U^2 \tag{5}$$

Scale of viscosity forces:

$$S_{F_v} = \frac{(F_v)_M}{(F_v)_N} = \frac{(\mu \frac{dU}{dn} \cdot A)_M}{(\mu \frac{dU}{dn} \cdot A)_N} = S_\mu \cdot S_U \cdot S_{lc} \tag{6}$$

Scale of pressure forces:

$$S_{F_p} = \frac{(F_p)_M}{(F_p)_N} = \frac{(p \cdot A)_M}{(p \cdot A)_N} = \frac{(p \cdot l_c^2)_M}{(p \cdot l_c^2)_N} = S_p \cdot S_{lc}^2 \tag{7}$$

From the equality of the inertial forces (5) and the viscosity forces (6) results:

$$S_\rho \cdot S_{lc}^2 \cdot S_U^2 = S_\mu \cdot S_U \cdot S_{lc} \tag{8}$$

from which results:

$$\frac{S_U \cdot S_{lc} \cdot S_\rho}{S_\mu} = 1 \tag{9}$$

from which results:

$$\frac{S_U \cdot S_{lc}}{S_v} = 1 \tag{10}$$

that is:

$$\frac{U_M \cdot l_{cM}}{U_N \cdot l_{cN}} = 1 \tag{11}$$

$$\frac{v_M}{v_N} = 1$$

from which results the condition for similitude:

$$\frac{U_M \cdot l_{cM}}{v_M} = \frac{U_N \cdot l_{cN}}{v_N} \tag{12}$$

From the equality of the inertial forces scales (5) with the pressure forces scale (7) results:

$$S_{\rho} \cdot S_{l_c}^2 \cdot S_U^2 = S_p \cdot S_{l_c}^2 \quad (14)$$

so the relation between scales is:

$$\frac{S_p}{S_{\rho} \cdot S_U^2} = 1 \quad (15)$$

that is:

$$\frac{P_M}{\rho_M \cdot U_M^2} = \frac{P_N}{\rho_N \cdot U_N^2} = 1 \quad (16)$$

and the condition for similitude is:

$$\frac{P_M}{\rho_M \cdot U_M^2} = \frac{P_N}{\rho_N \cdot U_N^2} \quad (17)$$

or:

$$E_{U_M} = E_{U_N} \quad (18)$$

As a result, through the method of forces the following were highlighted: Reynolds (R_e) and Euler (E_U) criteria, the conditions for similitude ($R_{e_M} = R_{e_N}$ and $E_{U_M} = E_{U_N}$) and the corresponding relations between scales ($S_U \cdot S_{l_c} \cdot S_v^{-1} = 1$ and $S_p \cdot S_{\rho}^{-1} \cdot S_U^{-2} = 1$ respectively). All these should be respected in the process of guiding of the under water vehicle movement.

In the above relation between scales, the scales signify:

- S_{l_c} – the scale of the characteristic lengths,
- S_U – the scale of speeds,
- S_{ρ} – scale of densities,
- S_{μ} – scale of dynamic viscosity,
- S_v – scale of cinematic viscosity,
- S_p – scale of pressures,
- S_k – scale of roughness.

4. Conclusions

The paper presents the research concerning underwater robots movement and brings the following original contributions:

- study of movements at reduced speeds of underwater robots, according to the parameter „time”, with modulated impulses, through the method of similitude;
- simulation of robots functioning at natural scale through the method of similitude and the determination of similitude conditions specific to the „Method of forces”;
- modeling of the movement at low speed of underwater robots through the method of similitude;
- the following are presented: the models of underwater robots used for experimental and numerical research, motivation as to why a certain model, with special destination was chosen, the project and making of the necessary mock-ups for trials.

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THE ANALYSIS OF A MAGNETISATION DEVICE USING FEMM

Adelina Rodica SAMOILESCU¹

Valentin IONIȚĂ²

¹ Drd.ing., Universitatea Politehnica București, Facultatea de Inginerie Electrică

² Prof.univ.dr.ing., Universitatea Politehnica București, Facultatea de Inginerie Electrică

Abstract: This paper analyses a magnetization device with cylindrical geometry which allows a 2-D approach using FEMM, a free software based on the finite elements method. The obtained values of the magnetic flux density in different regimes are compared for two main cases: with and without a magnetic sample inside the coil. Another comparison was made between the results obtained by the numerical simulation and by the analytical method.

Key words: magnetic materials, superconducting, analytical model.

1. Introduction

There are a few areas where magnetic materials could not be used. Since the middle of last century, researchers tried to find different solutions to magnetize different materials. With the appearance of more performante materials, which required the existence of stronger fields in order to be magnetized it was necessary to develop new and powerful equipment capable to resist to the demands that they have undergone [1]. One of the simplest equipment is the magnetizing coil.

Superconducting, resistive or hybrid coils are generally used to obtain strong magnetic fields [2]. One type of resistive coils is the Bitter coil. A Bitter coil is built from a succession of very thin conductive plates and insulating spacers stacked in a helical configuration. Water circulates through holes in the plates as coolant [3].

An optimization of a Bitter coil could be made using numerical methods, but some additional hypothesis must be considered. For example, if one ignores the cooling holes a cylindrical geometry is obtained. In this case a 2-D software could be used to solve the electromagnetic field problem. The paper presents some considerations regarding the results, taking into account an analytical approach too.

2. Analytical and Numerical Models

An analytical model must be used in order to validate the numerical results obtained by different numerical methods. A cylindrical coil is considered for the analytical computation of the magnetic field inside the coil (Fig. 1).

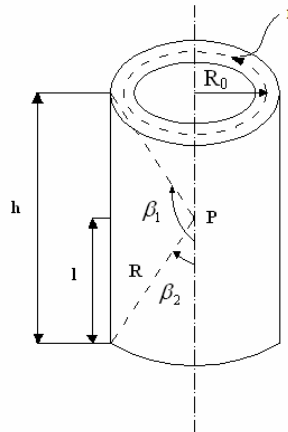


Fig. 1. Cylindrical coil of the magnetizer

The well known formula of Biot-Savart-Laplace was used, to calculate the magnetic flux density on the central axes of a solenoid [4]:

$$B = \int_{R_{int}}^{R_{ext}} \mu_0 \cdot \frac{n \cdot i}{2 \cdot h \cdot (R_{ext} - R_{int})} (\cos \beta_2 - \cos \beta_1) \cdot dR_0 \quad (1)$$

where R_{ext} is the outer radius of the coil; R_{int} is the inner radius of the coil; μ_0 is the vacuum permeability; n is the total number of turns; i is the current; h is the height of the coil; R_0 , β_1 and β_2 are specified in figure 1.

The previous formula was implemented in Matlab software generating analytical results for the magnetizer model.

The numerical model considers the magnetizer coil being composed by 24 copper disks forming 3 turns. The disks dimensions are: $R_{ext} = 95$ mm, $R_{int} = 25$ mm and the thickness of 2 mm. A current of 4480 A passes through the coil. The two dimensional analysis of the device was realized using the finite element method implemented in the software FEMM [5]. The geometry and the mesh are presented in figure 2.

The behavior of the device was studied in two cases: the device alone and afterwards with a sample with the relative magnetic permeability of 10000 placed in the middle of it. The analysis was made for the stationary magnetic regime and steady state AC permanent regime (at 50 Hz).

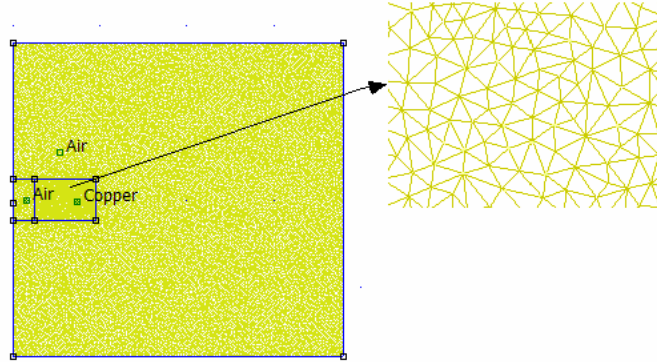


Fig. 2. Device geometry and mesh in FEMM

The electromagnetic field problem that must be solved is axisymmetric, therefore two of the three components of the magnetic vector potential \mathbf{A} are zero (the single component that remains is in the “out of the page” direction). From the same reason, in order to obtain the proper solution the Dirichlet boundary condition must be imposed on the axis of symmetry (middle line of the coil) [6].

3. Tests and Results

The first analysis of the device was made in the stationary magnetic regime. The device analysis gives us the values of the magnetic flux density inside the coil (Fig. 3).

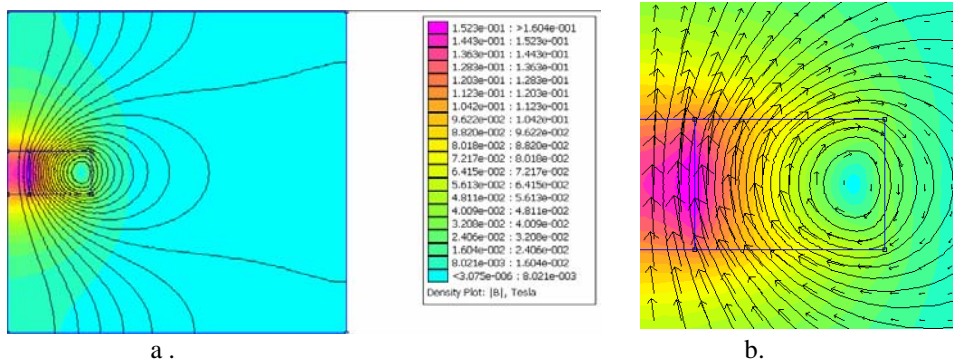


Fig. 3. Magnetic flux density map: a) global view; b) zoom in the coil region

The distribution of the magnetic flux density on the coil axis is represented in figure 4, the highest values being obtained in the middle of the coil.

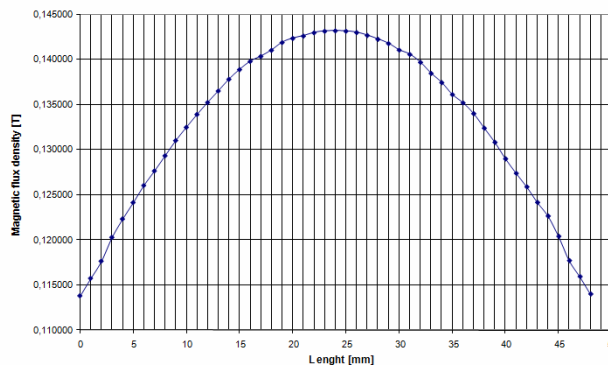


Fig. 4. Magnetic flux density vs. position on the coil axis

In the second test, the device was analyzed in the stationary magnetic regime, taking into account the presence of the high permeability sample ($\mu_r=10000$) in the middle of the device. The insertion of the sample concentrates the field lines around it (fig. 5). The magnetic flux density values in the middle of the coil are different in the two analyzed cases – see fig. 5b. vs fig. 4. The shape of the B curve has changed with the introduction of the sample, the values increasing in this case.

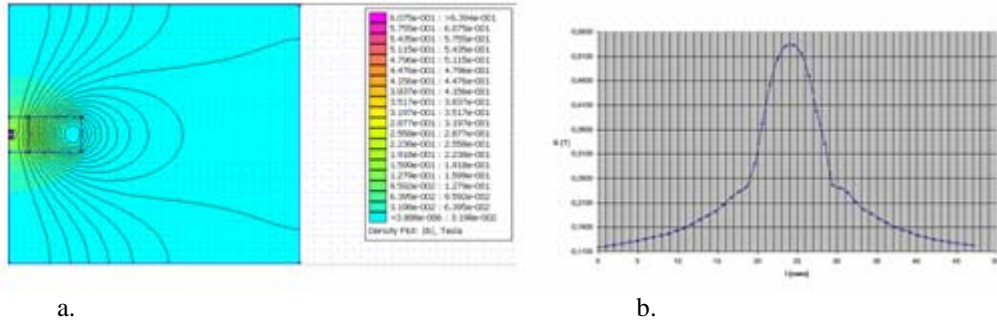


Fig. 5. Simulation at 0 Hz: a) Magnetic flux density map; b) Magnetic flux density vs. position on the coil axis

The third test analyses the device in steady state AC permanent regime at 50Hz. The results are represented in figure 6 showing the same convex shape of the B curve on the coil axis as in the stationary regime. Comparing the B values in different points for the steady state regime and for the stationary regime, one observes slightly higher values in the first case.

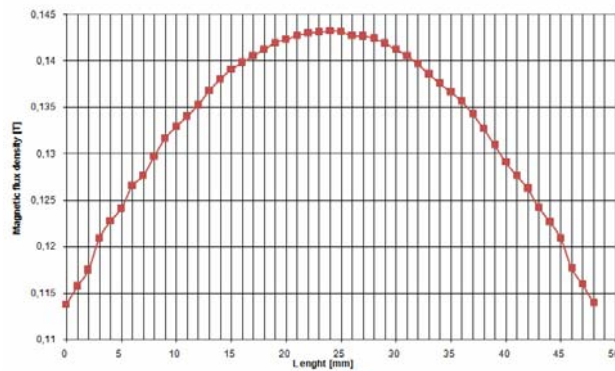


Fig. 6. Magnetic flux density vs. position on the coil axis at 50 Hz

Similar with the second test, a high permeability sample was inserted in the middle of the device coil, the magnetic field lines being concentrated around it (Fig. 7a.). In this case, the B curve along the middle axis has not the same shape as for the third test (Fig. 7b.).

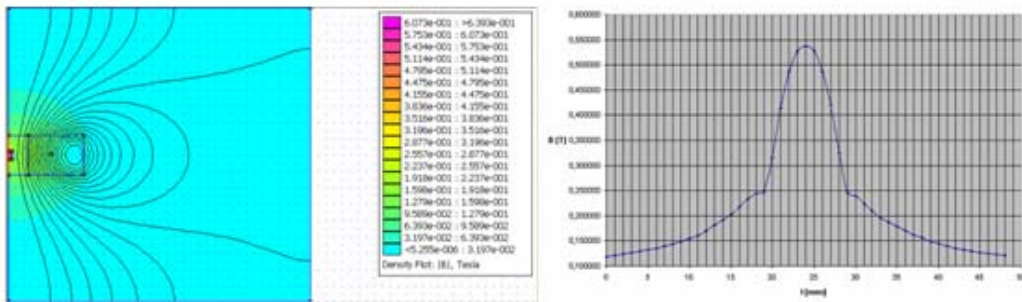


Fig.7. Simulation at 50 Hz: a) Magnetic flux density map, b) Magnetic flux density vs. position on the coil axis

The numerical results can be validated using the analytical model. The Biot-Savart-Laplace formula was implemented in a Matlab code, obtaining the dependence of the magnetic flux density on the middle axis (Fig.8).

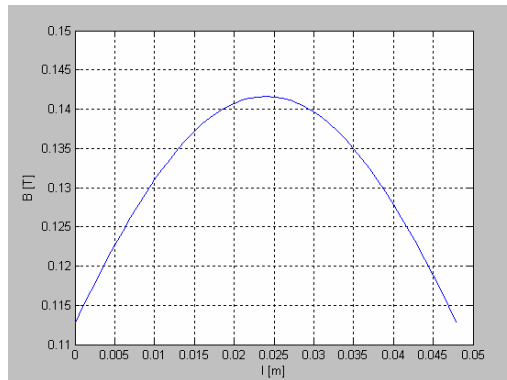


Fig.8. Magnetic flux density vs. position on the coil axis for the analytical computation

4. Conclusions

The magnetization device was analyzed using two approaches: a numerical model based on the finite element method implemented in FEMM software and an analytical model based on the Biot-Savart-Laplace formula, in order to validate the results. The simulations were done for two cases: magnetic stationary regime (0 Hz) and steady state permanent regime (50 Hz).

The results obtained in stationary regime are similar for the analytical and numerical models: FEMM shows a top value of 0.1432 T, while 0.1416 T is shown for the analytical method.

Modifying the frequency from 0 Hz to 50 Hz did not significantly influence the overall value of magnetic flux density – the values are higher, but not by much.

When a sample with high magnetic permeability is inserted in the middle of the device coil, the magnetic flux density in its area shows values between 0,36 T and 0,55 T. These values are 3 to 4 times higher than the results obtained when no sample was present. These results are due to the concentration of magnetic field lines in the sample and around it – the closer are the lines together, the higher the magnetic flux density values are.

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THE USE OF THE INITIAL PLAN METHOD TO MEASURE THE ELECTROMAGNETIC FIELD ON BOARD THE SHIP (EFBS)

Gheorghe SAMOILESCU¹
Mircea CONSTANTINESCU²
Alexandru SOTIR³
Camelia CIOBANU⁴
Laura CIZER⁵

¹ Naval Academy „Mircea cel Bătrân” Constanța, România

² Naval Academy „Mircea cel Bătrân” Constanța, România Naval Academy „Mircea cel Bătrân” Constanța, România

³ Naval Academy „Mircea cel Bătrân” Constanța, România

⁴ Naval Academy „Mircea cel Bătrân” Constanța, România

⁵ Naval Academy „Mircea cel Bătrân” Constanța, România

Abstract: This method implies the introduction of intermediary field sources in the shape of a plan (S) where the field distribution is experimentally determined. The statement for the problem of the initial plan method is as follows: knowing the values of EFBS in the measurement plan (S) situated at a normal measurement depth $h_s = h_n$, it is imperative to analytically measure the value of the field in another plan (S₁) situated at the depth $h > h_s$. An effective performance parameter, in evaluating the magnetic imprint of the ship, is the field gradient of the ship electromagnetic field component. In practice the field gradients pertaining to the longitudinal characteristics: $\frac{\partial H_x}{\partial x}$, $\frac{\partial H_y}{\partial x}$, $\frac{\partial H_z}{\partial x}$ are of utmost importance.

Key words: magnetic scalar potential, ferropubes

1. INTRODUCTION

The values of the function $V_m(x, y, z)$, $z > z_s$ are calculated. In order to determine the solution to $V_m(x, y, z)$, Green's function to Dirichlet problem for Laplace's equation is used and, respectively, Green's function to Neumann problem for Laplace's equation, with reference to the lower semispace [1, 2, 3].

Green's function to Dirichlet problem for Laplace's equation related to the lower semispace of the measurement plan leads to the following solution:

$$V_m(x, y, z) = -\frac{1}{2\pi} \iint_{(s)} V_{ms} \frac{z_s - z}{r^3} \cdot dx_s \cdot dy_s, \quad (1)$$

where:

$$r = \left[(x_s - x)^2 + (y_s - y)^2 + (z_s - z)^2 \right]^{\frac{1}{2}}, \quad (2)$$

Using Green's function to Neumann problem for Laplace's equation, with reference to the lower semispace, and also knowing the values $\partial V_{ms} / \partial z_s$, within the (S) plan, the $V_m(x, y, z)$ solution within (S₁) plan is determined by the equation:

$$V_m(x, y, z) = \frac{1}{2\pi} \iint_{(s)} \frac{\partial V_{ms}}{\partial z_s} \frac{1}{r} dx_s dy_s \quad (3)$$

Knowing the function of the magnetic scalar potential $V_m(x, y, z)$, in (S) plan, the H_x , H_y , H_z values of the components of the magnetic field intensity within this plan are determined with the help of equations no. (2) and (3). Thus, using equation no. (3), the following are determined:

$$H_x(x, y, z) = \frac{1}{2\pi} \iint_{(s), z_s=0} H_{zs} \frac{x_s - x}{r^3} dx_s dy_s, \quad (4)$$

$$H_y(x, y, z) = \frac{1}{2\pi} \iint_{(s), z_s=0} H_{zs} \frac{y_s - y}{r^3} dx_s dy_s, \quad (5)$$

$$H_z(x, y, z) = \frac{1}{2\pi} \iint_{(s), z_s=0} H_{zs} \frac{z}{r^3} dx_s dy_s. \quad (6)$$

Provided the values of the H_{zs} vertical field components within the (S) plan are known, the equations no. (4), (5), (6) allow us to determine the H_x , H_y , H_z components within a plan which is inferior to the plan where the measurements have been done.

Once the H_{zs} values have been determined by way of experimental work, the integrals in the equations no. (4), (5), (6) are replaced by sums:

$$dx_s \cdot dy_s = \Delta x_s \cdot \Delta y_s = \Delta S, \quad (7)$$

$$H_x(x, y, z) = \frac{\Delta S}{2\pi} \sum_{k=1}^n H_{zsk} \frac{x_{sk} - x}{r_k^3}, \quad (8)$$

$$H_y(x, y, z) = \frac{\Delta S}{2\pi} \sum_{k=1}^n H_{zsk} \frac{y_{sk} - y}{r_k^3}, \quad (9)$$

$$H_z(x, y, z) = \frac{\Delta S}{2\pi} \sum_{k=1}^n H_{zsk} \frac{z_{sk} - z}{r_k^3} \quad (10)$$

2. THE ANALYSIS OF THE INITIAL PLAN METHOD [1, 2. 4]

In order to use the equations no. (8), (9), (10) it is essential to determine only the vertical components of the magnetic field within the normal measurement plan.

Also, the accuracy of the vertical setting of the ferroprobe transducers influences the accuracy of results. For instance, if the vertical component is $Z_T = 400$ mOe and the transducer deviation from the vertical position is $0^\circ 30'$, there will be the following error: $\varepsilon = Z_T - Z_T \cos(0^\circ 30') = 0.015$ mOe.

When fastening the ferroprobes in upright position, the error must not exceed several minutes. To ensure the accuracy of calculation, the elementary surface – where the value of the vertical field component is constant – needs to be smaller, which requires a proper number of measurement points in the initial plan.

The magnetic field component developed by the ship depends on the period of time when the ship is underway on a constant course and at constant speed. This is the passing characteristic. All these issues have been dealt with in the 1st stage of our project.

Since they protect the ships against induction current – type mines, a matter of primary interest is represented by the dHz/dt differentials relating to the longitudinal passing characteristics of the compensated ship that has been checked up in the measurement experimental range.

By calculating the differential of the vertical component at different values of the ship speed, one can determine the speed she can safely sail within an area where the depth and the sensitivity of the used inductive mines. The speed at which the ship is able to operate in the dredging area and to use her means of mine sweeping is a characteristic of the ship efficiency and it determines the dimensions of the dredged area in a specified period of time.

In order to determine the dHz/dt parameter, the equation for the Hz vertical component gradient on the longitudinal axis can also be used, since:

$$\frac{dHz}{dt} \cong V_N \text{grad}_z Hz \quad (11)$$

Given a ship that operates her protection equipment and that has the following characteristics: $L=120\text{m}$, $B=11\text{m}$, $T=4,3\text{m}$; $h_n=9.0\text{m}$; $D_m=0^0$, $Y=0.00$, $V_N=9.0\text{m/s}$, the passing characteristics are as follows:

- the real passing characteristic $H_z(t)$;
- the approximate passing characteristic $H_{za}(t)$, calculated after taking into consideration the first five harmonics of Fourier series.

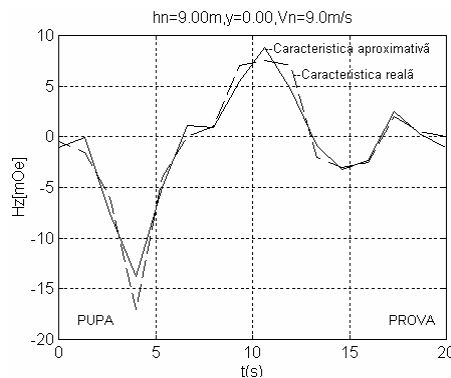


Fig. 1

Figure 1 shows that - when taking into consideration the first five harmonics – the approximate passing characteristics save the properties of the real characteristic. It also shows almost accurately its practical purposes.

An optimal magnetic characteristic is represented by partially flattened curve that has a reduced number of critical points but a great distance between them, and reduced field values. As a result of such a flattened shape, the field gradients will have reduced values as compared with the respective coordinate. In the case of ships, because of the reduced number of measurement points of the magnetic field within the safety plan, figure 2 shows the way in which measurements have been done to determine the field gradients by taking into consideration the distance between the measurement points $\Delta x = ct$. and, respectively, $\Delta y = ct$.

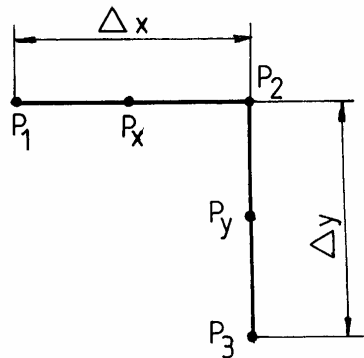


Fig. 2

Now that the vertical components of EFBS have been determined in the three represented points, the result is as follows:

$$\left. \frac{\partial H_z}{\partial x} \right|_{P_x} \cong \frac{H_{z1} - H_{z2}}{\Delta x} \quad (12)$$

$$\left. \frac{\partial H_z}{\partial y} \right|_{P_y} \cong \frac{H_{z2} - H_{z3}}{\Delta y} \quad (13)$$

The field gradients that have been calculated in the above-mentioned equations are related to P_x , P_y points, situated at half the distance between the measurement points that have been taken into consideration.

Another important aspect is the fact that both the magnetic characteristics associated with the compensation errors and those associated with the field gradients are not time invariable.

3. CONCLUSIONS

The magnetic imprint of a naval ship is characterized by the following elements that define her degree of risk.

- the maximum compensation errors that determine the values of the vertical field in the safety plan (the field determined by the ship-compensating winding group, in the measurement plan). The less the compensation errors, the higher the performances. Since the superposition of the fields created by the compensating windings does not trigger satisfactory results, the assessment of the magnetic imprint will necessarily be done through measurements.
- the field gradients developed by the ship compensating windings group allow us to determine the ship speed ($VN=ct.$) in the operational area or in minefields. Knowing the field gradients, the differentials can be determined as compared with the time period. These values are also compared with the sensitivity of special objects used to destroy the ships.

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IMPLEMENTATION OF JAVA SOFTWARE TO DETERMINE THE EQUIVALENT RELIABILITY OF A COMPLEX SYSTEM

Cosmin ȘTIRBU¹
Constantin ANTON²
Emil SOFRON³

¹As. drd. ing., University of Pitesti

²Gl. bg. r. dr. ing., University of Pitesti

³Prof. dr. ing., University of Pitesti

Abstract. In this paper we present the calculation of the equivalent reliability of a non decomposed system using a method based on graphs theory. To improve the speed of the calculation we create JAVA software, which can be easily used in practice. This software allows the calculation of the reliability for any configuration of electronic system. The reliability coefficient is very useful in the fault diagnosis of the systems.

Keywords: reliability, node, graph, non decomposed system

INTRODUCTION

The reliability of a system is the probability that an item will perform a required function without failure under stated conditions for a stated period of time. The reliability coefficient is a number between 0 and 1.

In practice there are serial, parallel, serial- parallel and parallel-serial and non decomposed systems [4]. For serial, parallel, serial-parallel and parallel-serial systems there are calculation formulas of the equivalent reliability [3].

In the case of the serial systems the equivalent reliability is:

$$R_s(t) = \prod_{i=1}^n R_i(t) \tag{1}$$

where R_i is reliability of each item the system and n is the number the items.

In the case of the parallel systems the equivalent reliability:

$$R_p(t) = 1 - \prod_{i=1}^n [1 - R_i(t)] \tag{2}$$

where R_i is reliability of each item the system and n is the number the items.

The serial-parallel and parallel-serial systems can be decompose in ordinary serial and parallel system.

For the non decomposed systems there isn't a clear calculation formula of the equivalent reliability. We propose a calculation method for this kind of systems based on graphs theory, by making analogy between a graph and a system.

1. CALCULATION METHOD OF THE A RELIABILITY BASED ON GRAPH THEORY

To calculate the equivalent reliability of a non decomposed system, we use the graph theory [1][2]. In this way the system presented below, it can be equivalent to a graph; $x_1...x_7$ represents link nodes between the components of the non decomposed system.

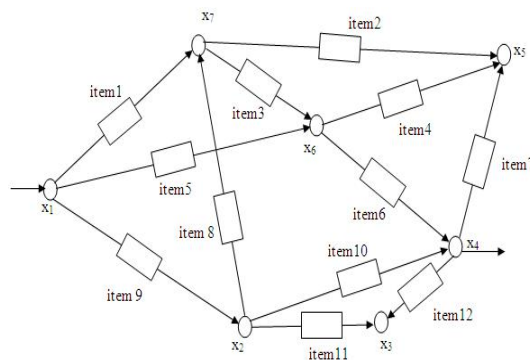


Figure 1. Non decomposed system

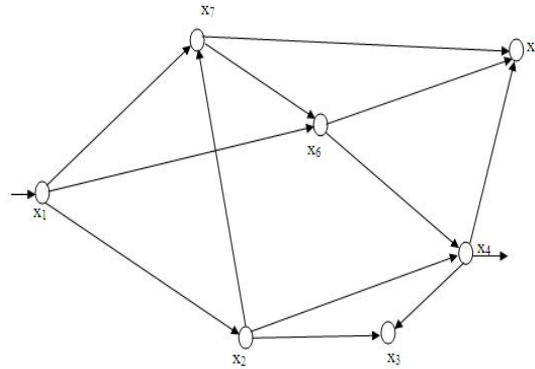


Figure 2. Graph of non decomposed system

1.1. Rule of transmittance adding between two nodes

We suppose that between two nodes x_1 and x_2 are connected with two arcs in parallel (electro technical meaning) by transmittances t'_{12} and t''_{12} .

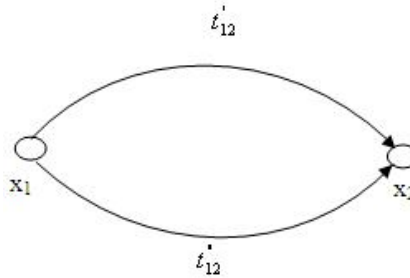


Figure 3. Graph formed by two nodes connected by two arcs in parallel

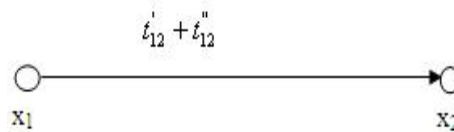


Figure 4. Equivalent graph

The equation corresponding to a simple graph is:

$$x_2 = t'_{12}x_1 + t''_{12}x_1 \tag{3}$$

that can be write

$$x_2 = (t'_{12} + t''_{12})x_1 \tag{4}$$

and the correspondent graph is presented in the figure 4. Then it results from above:

1.2. Adding rule

Two parallel arcs and with the same sense can be replaced by one arc, whose transmittance is equal with the sum of initial arc transmittance [2].
 The rule is applicable obviously in the case that the nodes x_1 and x_2 , are the same, so when the arcs in parallel are specific loops placed in the same node. It is extended for the case that we have a certain number of parallel arcs and with the same orientation.

The rule has the effect to eliminate some arcs.

1.3. Transformation of a mixed node in a well node

We suppose that we have a graph without specific loops and without opposite sense arcs, that connects the same nodes [2]. We take in consideration the graph from the figure 5 with a mixed node in x_2 and the corresponding system

$$\begin{cases} x_2 = t_{12}x_1 \\ x_3 = t_{23}x_2 \end{cases} \tag{5}$$

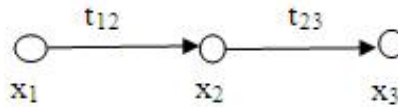


Figure 5. Graph with a mixed node

The system is equivalent with

$$\begin{cases} x_2 = t_{12}x_1 \\ x_3 = t_{12}t_{23}x_1 \end{cases} \quad (6)$$

the system whose graph is in figure 6 and the mixed node x2 is transformed in a well node.

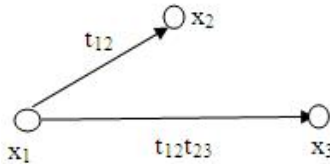


Figure 6. The graph for the system from (6)

If we are interested only about relation [2] between the signals x1 and x3, we have the subgraph from the figure 7.

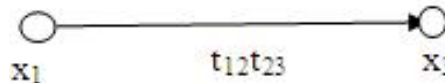


Figure 7. Subgraph for the signals x1 and x3

from which the node x2 was eliminated. Then we have:

1.4. The multiply rule

The two arcs in serial and with the same sense can be replaced by a single arc with a transmittance equals with the product of transmittances of initial arcs (only we are interested in the graph transmittance between the terminal nodes).

The rule is extended to a way that is passing by the nodes x1, x2, ..., xn, each mixed node x2, x3, ..., xn-1 has a single convergent and a single divergent arc, namely the way transmittance is equal with product of arc transmittances. From the graph from the figure 8 and system (7)

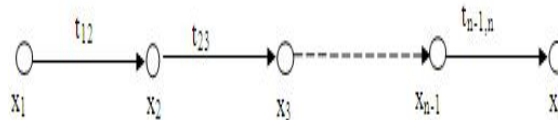


Figure 8. Graph with n nodes

$$\begin{cases} x_2 = t_{12}x_1 \\ x_3 = t_{23}x_2 \\ \dots\dots\dots \\ x_n = t_{n-1,n}x_{n-1} \end{cases} \quad (7)$$

we obtained the system

$$\begin{cases} x_n = t_{12}t_{23}\dots t_{n-1,n} x_1 = T_{1n}x_1 \\ x_{n-1} = t_{12}t_{23}\dots t_{n-2,n-1}x_1 = T_{1,n-1}x_1 \\ \dots\dots\dots \\ x_2 = t_{12}x_1 = T_{12}x_1 \end{cases} \quad (8)$$

which graph is presented in the figure 9. The first from these equations generalizes the multiply rule.

The rule is applied also for a loop, in analogous conditions that the previous way: the transmittance of a loop is equal with the product of the transmittances of their arcs.

We suppose now that in the mixed node are two convergent arcs and two divergent ones, so it results the graph from the figure 10 with mixed node x3 and the source nodes x1 and x2 and the system

$$\begin{cases} x_3 = t_{12}x_1 + t_{23}x_2 \\ x_4 = t_{34}x_3 \\ x_5 = t_{35}x_3 \end{cases} \quad (9)$$

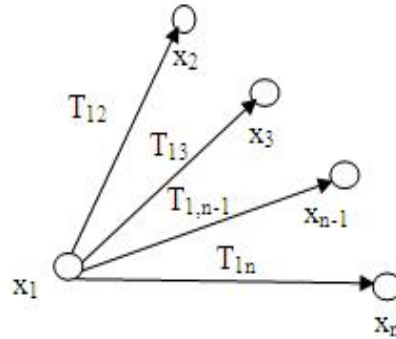


Figure 9. The graph of system (8)

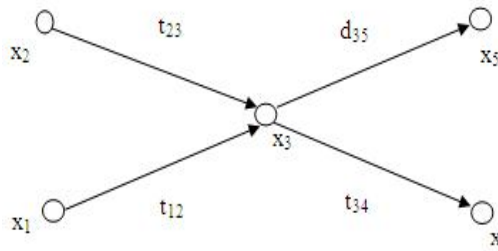


Figure 10. The graph with the mixed node x_3 and the source nodes x_1 and x_2

System can be write

$$\begin{cases} x_3 = t_{12}x_1 + t_{23}x_2 \\ x_4 = t_{12}t_{34}x_1 + t_{23}t_{34}x_2 \\ x_5 = t_{12}t_{35}x_1 + t_{23}t_{35}x_2 \end{cases} \quad (10)$$

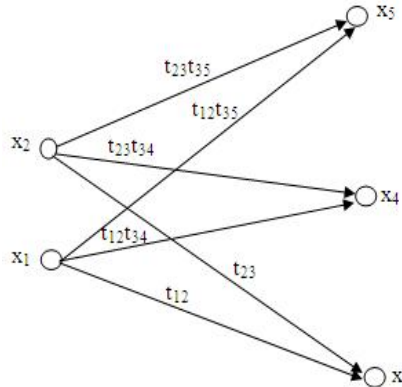


Figure 11. The graph of system (10)

With the graph from the figure 11, so the mixed node x_3 is transformed in a source node with the same convergent arcs like in the in the initial graph. The two well nodes have two convergent arcs each. (how many well nodes are connected to the mixed node take in consideration), their transmittances are equals with the way transmittances from the source nodes to the well nodes. The generalization for a mixed node connected to more source nodes and much more well nodes is immediate.

1.5. The rule of transformation of a mixed node into a well node

A mixed node is transformed into well node by keeping only convergent arcs in it with non modified transmittances. The well nodes are keeping the nature, however they have as many convergent arcs like as many source nodes are, their transmittances are equal with the transmittances of ways from the source nodes to them.

In the case that the links of the mixed node don't interest us, we eliminate the node from this graph and we have

1.6. Elimination rule of a mixed node

By the elimination of a mixed node [2], in each well node enters how many arcs as ways there are from the source nodes to it, their transmittances are equal with the transmittances of the respective ways.

1.7. Example

We have the graph and the corresponding system

$$\begin{cases} x_2 = t_{12}x_1 \\ x_3 = t_{23}x_2 + t_{43}x_4 \\ x_4 = t_{24}x_2 + t_{64}x_6 \\ x_5 = t_{45}x_4 + t_{65}x_6 + t_{75}x_7 \\ x_6 = t_{16}x_1 + t_{76}x_7 \\ x_7 = t_{17}x_1 + t_{27}x_2 \end{cases} \quad (11)$$

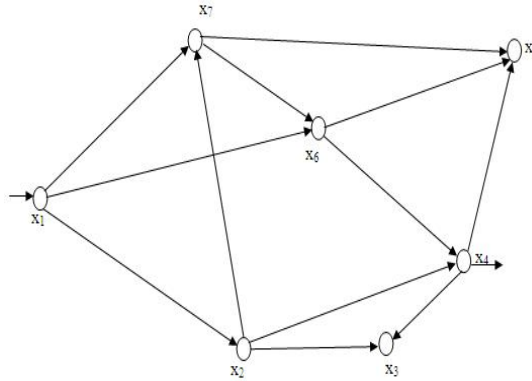


Figure 12. The graph of the system (11)

To transform the mixed node x_6 in a well node [2], it has to eliminate the unknown x_6 in the equations of the system, in the second member, to cancel the arcs that leave from x_6 . This modification has to be made only in the third and the fourth equations. But in this way we can modify only the transmittances of arcs, which link x_1 and x_7 with x_6 (in conformity with the last but one relation) and this in the equations mentioned above. Then it's enough to take in account the graph that contains the node x_6 and the nodes linked directly by an arc with this, without to take in consideration the arcs that link these last nodes (figure 13). Transforming in this graph the node x_6 in a well node, we obtain the graph from the figure 14, in which the arcs are drawn dotted. The corresponding system of equations is obtained easily.

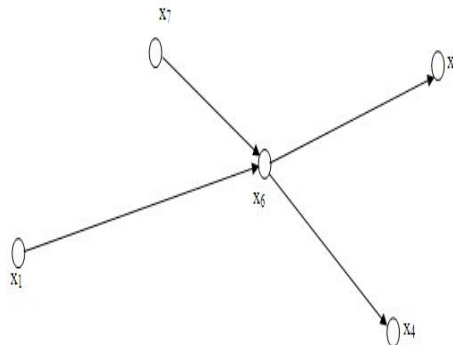


Figure 13. The graph that contains the node x_6 and the nodes linked directly by an arc with it

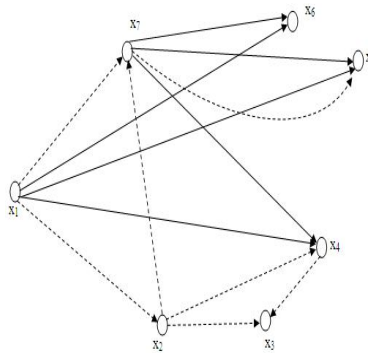


Figure 14. The graph obtained by the transformation of the node x_6 in a well node

We suppose that for the graph from the figure 14 we are interested only about the transmittance of the graph from the node x1 to the node x4. The well nodes, the others ones that x4, are canceled, also like the corresponding equations. The succession of graphs and the systems is below (figure 15):

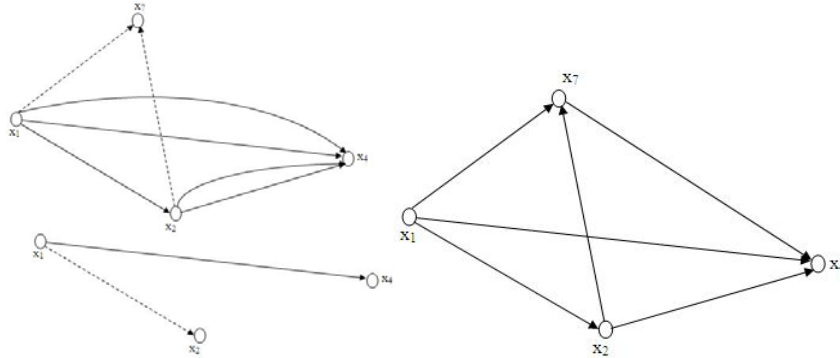


Figure 15. The succession of graph, after the neglecting of the well nodes

$$\begin{cases} x_2 = t_{12}x_1 \\ x_4 = t_{24}x_2 + t_{16}t_{64}x_1 + t_{76}t_{64}x_7 \\ x_7 = t_{17}x_1 + t_{27}x_2 \end{cases} \quad (12)$$

By transforming the node x7 in a well node, and then we eliminate it, we obtain

$$\begin{cases} x_2 = t_{12}x_1 \\ x_4 = (t_{16}t_{64} + t_{17}t_{76}t_{64})x_1 + (t_{24} + t_{27}t_{76}t_{64})x_2 \end{cases} \quad (13)$$

Then, by the transformation of the node x2 in a well node, we found

$$\begin{cases} x_2 = t_{12}x_1 \\ x_4 = (t_{16}t_{64} + t_{17}t_{76}t_{64} + t_{12}t_{24} + t_{12}t_{27}t_{76}t_{64})x_1 \end{cases} \quad (14)$$

From where, we neglect x2 and we obtain the researched signal

$$x_4 = (t_{16}t_{64} + t_{17}t_{76}t_{64} + t_{12}t_{24} + t_{12}t_{27}t_{76}t_{64})x_1 \quad (15)$$

And it's easy to see that for the graph of the system from the figure 12 that the transmittance obtained is the sum of transmittances of all the ways that start from x1 and stop in x4

$$T = t_{16}t_{64} + t_{17}t_{76}t_{64} + t_{12}t_{24} + t_{12}t_{27}t_{76}t_{64} \quad (16)$$

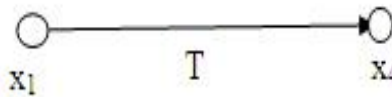


Figure 16. The equivalent graph with the equivalent transmittance T for the system from the figure 12

By analogy with the relation from above, the initial non decomposed system, (figure 1) is decomposed in a serial –parallel system.

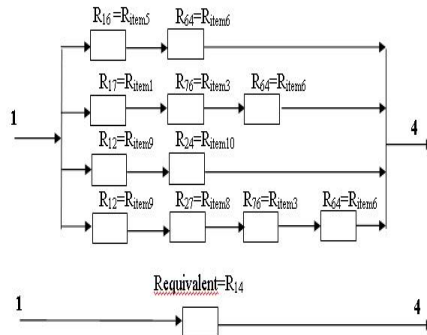


Figure 17. The equivalent serial –parallel system for the system from figure 4.19

The reliability of the system is calculated like this:

$$R_{equivalent\ 14} = R_{16} R_{64} \parallel R_{17} R_{76} R_{64} \parallel \parallel R_{12} R_{24} \parallel R_{12} R_{27} R_{76} R_{64} \quad (17)$$

is taken in account that for the serial items and parallel items, (symbolized in relation with \parallel), it is used the two relations from the introductive part.

2. JAVA SOFTWARE TO CALCULATE THE RELIABILITY OF A NON DECOMPOSED SYSTEM

Starting with the mathematical bases presented above, the author develops a packet of software written in Java language [5], that calculates the reliability of a non decomposed system that are a personal contribution.

The packet contains two software: “Adjacent” that memorizes in a text file the adjacent matrices of the modeling system like a graph. The transmittances of the graph will be replace by the coefficients of reliability R and the software „Calculation Reliability” that calculates the reliability of the system between two nodes given.

The software demands to use the name of the file, the number of nodes, also the coefficient R to each directly connection between two nodes of the system.

Thus for the system below,

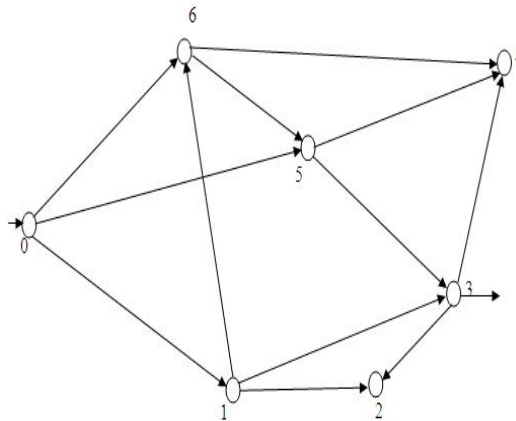


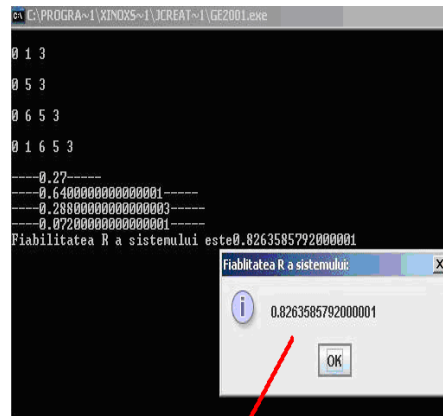
Figure 18. The modeling system like a graph, to whose it is created the adjacent matrices

we'll have a number of 7 nodes, and the number of directly connections in the way sense is 12 . Then, we introduce the R coefficient in the connection 0 and 1, 0 and 5, 0 and 6,, 6 and 5, 6 and 4.

Below is presented an adjacent file.txt:

```
0.0, 0.45, 0.0, 0.0, 0.0, 0.58, 0.9,
0.0, 0.0, 0.58, 0.77, 0.0, 0.0, 0.28,
0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
0.0, 0.0, 0.47, 0.0, 0.69, 0.0, 0.0,
0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0,
0.0, 0.0, 0.0, 0.25, 0.78, 0.0, 0.0,
0.0, 0.0, 0.0, 0.0, 0.8, 0.4, 0.0,
```

By rolling the second software JAVA, “CalculationReliability”, based on adjacent matrices calculated in the previous software, it displays us the reliability of the system calculated between an entrance node and a exit node given, also it will be displayed the ways between the two nodes



Equivalent reliability

Figure 19. Captures of screen from the JAVA software “CalculationReliability”

In the figure 19, it was calculated the reliability R of the system between the node 0 and the node 3.

CONCLUSIONS

In purpose to diagnose the defects of the electronic systems, an important role is the calculation of their reliability, the indicators of reliability are tightly connected with the break down probability of them. The personal contributions are the elaboration of the calculation method and the JAVA software [5] to calculate facile the reliability of the non decomposed systems. This software, allow to calculate rapidly and easily the reliability of the systems and they can be used easily in practice. Based on the software that we proposed it can be realized calculation software for any configuration of electronic system.

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ALUMINIUM ALLOYS STRUCTURES, MECHANICAL PROPRIETIES AND AFTER CASTING TREATMENTS

Dan TOKAR¹
Ion SPOREA²

Arina NEGOIȚESCU³

¹ Drd. Tokar Dan, Politehnica University Timișoara

² Prof.dr.eng. Sporea Ion, Politehnica University Timișoara

³ Eng, Negoitescu Arina, Politehnica University Timișoara

Abstract: Cast aluminium alloys pistons in the engine heat, on the basis of ternary system Al-Si-Cu aim to increase the mechanical resistances, especially the increasing resistance of the duration of the operating temperature of heat engines pistons exceeding 300 °C. In order for this work is studied in two alloys that contain Mn besides of high quantity Cu. Based on these alloys are being alloying other elements that result in mechanical tests show a jump in net terms of refractory due to the structure of the strengthening stable phases: Al_7Cu_2Fe , $W (Al_xMg_5Si_4Cu_4)$.

Keywords: aluminum alloys, alloy components and phases, heat treatment

1. Introduction

In order to increase mechanical properties of silumin alloys for casting of heat engines pistons, especially refractory, is used alloying method of metals from transition groups, obtaining the aluminium alloys multi components (polinary [4]). Multi component alloys based on the system Al-Si-Cu belong to cuprous silumin by high resistance and are multi-phase alloys. In this group includes alloys: $ATSi_5Cu_2MgMn$, $ATSi_5CuMg$, s.a

Because high content of detrimental inclusions of Fe (0,6% for the casting FAFT, 1,0% casting in chills and 1.5% pressure casting), the characteristics of resistance to the first two alloys is reduced. But if the Fe content is limited to 0.2%, then $ATSi_5Cu_3MgMn$ and $ATSi_5CuMg$ alloys may have $R_m=30daN/m^2$ a elongation $A>3\%$.

2. Alloys composition and proprieties

Chemical composition of $ATSi_5CuMg$, $ATSi_5Cu_3MgMn$, alloys is presented in Table.1, and Al is rest.

Both alloys possess relatively good casting properties [2], [3], but cleave least toward $ATSi_{10}MgMn$; $ATSi_7Mg$ alloys. At the same time must emphasize that the alloys $ATSi_5Cu_2MgMn$ and $ATSi_5CuMg$ alloys are less inclined to gas saturation and porosity formation in gaseous PT. $ATSi_5CuMg$ alloy It is used mainly for cylinder heat casting by internal combustion engine with cooling air, and alloy $ATSi_5Cu_2MgMn$ for complex PT (wings, equipment, installations and other pieces of air conditioning). Both alloys are used for PT, which working, manly a long term at high temperatures. Under these circumstances working against PT is required:

- Keeping the dimensions in long-exploitation;
- Good machinability by cutting;
- A sufficient strength, especially hardness.

Table.1 The alloys components [%] type silumin

| Alloy/ Components | Si | Cu |
|----------------------|------------|-----------|
| $ATSi_5Cu_3MgMn$ | 4,5-5,5 | 1,5 – 3,4 |
| $ATSi_5CuMg$ | 4,5-5,5 | 1,0 – 1,5 |
| Alloy/ Components | Mg | Mn |
| $ATSi_5Cu_3MgMn$ | 0,3 – 0,6 | 0,6 – 0,9 |
| $ATSi_5CuMg$ | 0,35 – 0,6 | - |

These requirements in the greatest degree alloy $ATSi_5Cu_2MgMn$ answer. Instead alloy $ATSi_5CuMg$ il little more about the properties of casting.

Proved that the alloy $ATSi_5CuMg$ gain maximum effect by strengthening the TT content of Mg = 0.6%. However, it must be said that this case decreases considerably plasticity compared with the alloys containing Mg=0,4 – 0,5%. Therefore, the Mg content should be below 0.5%.

In order to refractory increase of the alloy Cu content must be increased to 2.5%, and the Mn up to 0.8%. It appeared that the new alloy $ATSi_5CuMgMn$ refractory possesses more than 10% comparative alloy $ATSi_5CuMg$.

In $ATSi_5CuMg$ alloy Fe is always found, along with Al and Cu form practically insoluble phase $N(Al_7Cu_2Fe)$. Phase Al_7Cu_2Fe are R_{cr} tetragon crystalline parameters $a_1 = 6.32$ and $a_3 = 14.78$ Å. Crystallize in the laminate or flaky form

Mg adding in the $ATSi_5CuMg$ alloy, which contains Cu and Si, change very strongly as phase composition and properties of mechanical, refractory especially. Content in relation to Mg/Si = 1:1,73 Mg_2Si phase appears. If this report is below 1.08, the alloys of the type $ATSi_5MgCu$ phase $W (Al_xMg_5Si_4Cu_4)$ participating in the strengthening of alloys. Where Cu is in surplus in the alloy structure and phase $CuAl_2$ appears.

Structure of typical composition alloy after cooling in equilibrium (very non-shock chilling by $T_{cr}=0$) contains the following phases: $ss\alpha$, Si, $W (Al_xMg_5Si_4Cu_4)$ and still one of the two phases Mg_2Si or $CuAl_2$, is determined by the report quantities of Cu and Mg. Primarily on strengthening alloys $ATSi_5CuMg$ and $ATSi_5Cu_2MgMn$ after thermal treatment by precipitation of cold tempering has $CuAl_2$ and Mg_2Si phases, while these refractory alloys primarily depend by this structure of their phase Al_7Cu_2Fe și $W(Al_xMg_5Cu_4Si_4)$.

When $ATSi_5CuMg$ alloy in the Fe content is high, phase instead of $W(Al_xMg_5Si_4Cu_4)$ can form $AlCuSiFe$ phase of variable chemical composition. Both phases are divided easily in the form of both the crystallization and the capacity to chemically attack the metallographic samples.

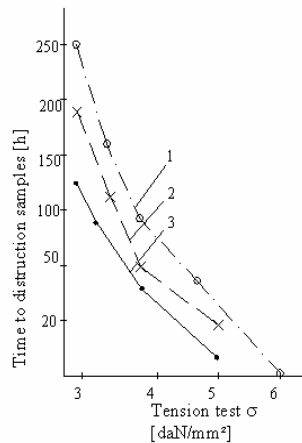


Fig. 1 Sustained load strength determined on samples cast in the FAT, ATSi₅CuMg alloy at a temperature of 300 ° C depending on the state test and tension σ : 1 - Casting 2 - after T6 thermal-treated, 3 - thermal-treated T6 + 100h after stabilization at 300°C before T₆

The degree of efficiency of the addition of Mg in alloys silumin type (to increase the mechanical resistance and the preservation of a satisfactory plasticity) depends on the absolute quantity of content in Si.

The most favorable is the addition of 0,35-0,6% Mg alloy in ATSi₅CuMg; 0,25-0,4% alloy in ATSi₇Mg and 0,17-0,3%Mg alloy in ATSi₁₀MnMg type.

Note: Note that all SILUMIN alloys type, the MINIMUM content of MAGNESIUM possess a high PLASTICITY, reduce the minimum limit of mechanical resistance and plastic yield, and an INCREASED MAGNESIUM content is INVERTED phenomenon- distinguishable resistance increases and decreases the plasticity. Such action of Mg on the mechanical properties of silumin alloys is necessary to have in mind when certain necessary mechanical properties.

Appearance of the curves of variation of sustained load strength (Fig.1) ATSi₅CuMg temperature alloy by 300°C, depending on the alloy state and tension test ensue that:

- Maximum refractory alloy is cast in the state (a)
- Refractory in the thermal treated (T6 regime) get an intermediate position (b)
- Refractory alloy is stabilized in the state minimum (c)

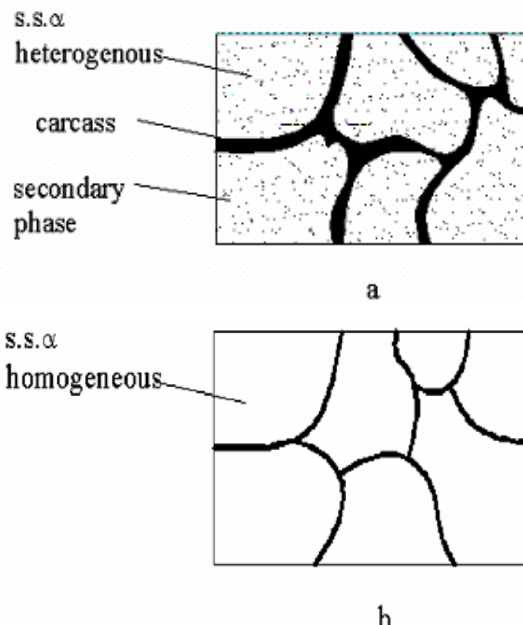


Fig. 2 Structure ATSi₅CuMg alloy in states: a cast; b- tempering (s.s. α - α solid solution)

The causes that determine this comportment can be explained by that: in the cast of the separation limits of the α solid solution granule are more strengthened processed from the heat (and mainly in the state stabilized)

This shows that the cast state structure alloy, the phases of secondary particles formed a carcass, and thereby hamper the processes of diffusion and dislocation movement, during which the heating for hardening the carcass is destroyed (Fig. 2), id

dissolve in α solid solution becomes homogeneous (the heat for hardening) and remains in force after the return of cold water at ambient temperature a certain time

This shows that the cast state structure alloy, the phases of secondary particles formed a carcass, and thereby hamper the processes of diffusion and dislocation movement, during which the heating for hardening the carcass is destroyed (Fig.2), id dissolve in α solid solution becomes homogeneous (the heat for hardening) and remains in force after the return of cold water at ambient temperature a certain time. And to note that in α solid solution cast is heterogeneous (contains secondary phases distributed uniformly in the crystalline granules to α solid solution), while these stages have disappeared after hardening that were dissolved in α solid solution become homogeneous.

To note that the stabilization process micro heterogeneousness structure α solid solution (inside granule) disappears in most measurement (α solid solution became homogeneous). This is an additional case of ATSi₅CuMg refractory alloy reducing.

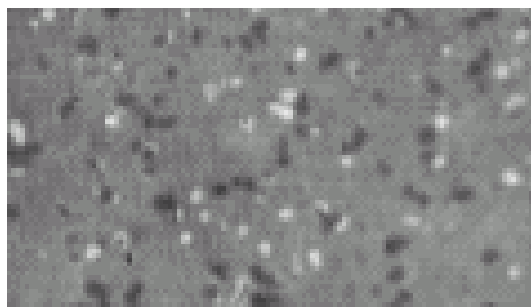


Fig. 3 Thermal engine cylinder heads with air cooled, cast alloys ATSi₅CuMg and ATSi₅Cu₂MgMn

Note: When determining the chemical composition of "optimal" ATSi₅Cu₂MgMn alloy (based on ATSi₅CuMg alloy) was held to the requirements of the industry:

- a) New alloy must possess sufficiently good casting properties to replace ATCu₄MgNi₂ (Y) another alloy thick used in foundry, but non- technological casting cylinder head cover, cylinder engine with air cooled heat
- b) Refractory new alloy must be higher than ATSi₅CuM refractory alloy.

Figure 3 shows casting pieces with many winged heads of thermal engine cylinders high power air-cooled, cast in metal moulding ATSi₅Cu₂MgMn alloy.

These castings the moulding, considered complex, we show that alloy has good casting properties, is technology.

3. Conclusions

Of the stated until concluded the following conclusions regarding refractory. Refractory high can the foundry alloys with the aluminium in the structure:

1. First, there is a α solid solution allied complex with Ea with a value reduced coefficient of diffusion in Al, but not form a strong crystalline network of tense matrix;
2. In the second row, the separation limits of granular α solid solution is well blocked by the stable phase, in which crystallized form branched;
3. In the third row, in the granule α solid solution to be a large quantity (a high density) of ultra dispersed particles stable secondary phases, well to prevent dislocated movement at working PT temperatures. Therefore alloying the SILUMINIU binary type alloys with magnesium, not form ternary combinations of aluminium and silicon, and also do not create a micro heterogeneousness inside α solid solution granule, NO can provide of high REFRACTORY silumin alloys type.

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WATER BASED TECHNOLOGIES USED ON DIESEL ENGINES FOR THE REDUCTION OF NO_x EMISSIONS

Adrian TRIFAN¹
Daniel MĂRĂȘESCU²

¹ Lt(r). drd. ing. Academia Navală Mircea cel Bătrân

² Asp.ing. Academia Navală Mircea cel Bătrân

Abstract: *Theoretical and experimental evidence indicates that NO_x reductions due to various water injection modes range from 10 to 80 percent for intake air humidification / water injection, 20 to 50 percent for direct injection and 10 to 50 percent for fuel-water emulsions. The effects of water on other emissions, such as particulate matter, carbon monoxide, total hydrocarbons and smoke, also vary for each method; NO_x reduction is often accompanied by increases in other emission products. WIS design thus becomes an optimization problem of maximizing NO_x reduction while minimizing the increase of other emissions.*

Keywords: *pollution, fuels, water, burning,*

1. Introduction

NO_x formation in diesel engines is a very complex process and despite years of experimental research and modeling work it is still not fully understood. The current understanding of these process comes from direct measurements as well as study of flames under simplified conditions. This is then linked to the existing knowledge of diesel combustion.

This paper will present the water based NO_x emission control technologies used on marine diesel engines.

Specifically the following technologies:

- Humid air motor (HAM);
- Combustion Air Saturation System (CASS);
- Direct water injection (DWI);
- Saturation air motor (SAM).

The intent of the paper is to explain the processes, mechanisms, and impacts of water introduced in the diesel engine, on NO_x emission reduction and engine operation.

2. NO_x formation

There are a number of different formation mechanisms responsible for NO_x in combustion processes. The relative importance of these different mechanisms is strongly affected by the temperature, pressure, flame conditions, residence time and concentrations of key reacting species.

2.1. Thermal NO

The thermal mechanism, also known as "extended *Zeldovich* mechanism", is responsible for the majority of NO_x emissions from diesel engines when peak combustion temperatures exceed 2000 K.

Since temperatures of this magnitude are desirable to maximize engine efficiency, this mechanism has been studied extensively and is fairly well understood. The three chemical reactions that are important in this mechanism are:



The overall reaction rate for this mechanism is slow and it is very sensitive to the temperature. As a consequence, thermal NO only appears in significant quantities in the post combustion. Also, the actual NO concentration from this mechanism deviates significantly from equilibrium concentrations.

This gives this mechanism a very strong time dependence that is important for low speed engines.

2.2. Prompt NO

The prompt NO mechanism, also known as the "*Fenimore* mechanism", is very rapid and results in NO formation in the combustion zone. The most important pathway for prompt NO is initiated by the rapid reaction of hydrocarbon radicals from the fuel with molecular nitrogen, leading to the formation of amines or cyano compounds that subsequently react to form NO. The most important initiation reaction for prompt NO is:



Subsequent rapid conversion to NO is strongly affected by O and OH. Prompt NO is most significant when combustion occurs at fuel concentrations higher than stoichiometry where there is a high concentration of hydrocarbon radicals to form HCN and the concentrations of O and OH are still high enough to cause the HCN to proceed to NO through the following reaction sequence:





2.3 N₂O pathway

Another NO formation mechanism important in combustion is the N₂O pathway. The initial reaction for this pathway is the three body reaction:



While N₂O generally reverts back to N₂, this is not always the case. Under conditions where the air/fuel ratio is lean, NO can form through either of the following two reactions:



This NO formation route is fuel and pressure dependent. At higher pressures and lower temperature, the three-body initiation becomes competitive with the O + N₂ reaction in the thermal mechanism.

These are the most important formation mechanisms.

3. Regulations

There are a number of national and international regulatory organizations that propose limitations on NO_x as well as other harmful emissions. The International Maritime Organization (IMO), through the International Convention for the Prevention of Pollution from Ships (MARPOL, Annex VI) regulates this on a global level. They have developed an approach to reducing green house gas (GHG) emissions, including NO_x. Member countries of the IMO must therefore adhere to the regulations that they have put forth. However, some organizations have committed to adopting regulations that are more stringent.

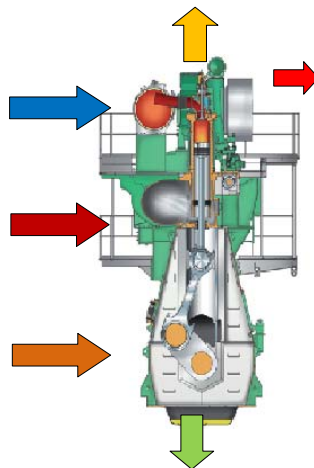


Fig.1 Emissions resulted from the diesel engine

The MARPOL, Annex VI, NO_x emission limits are:

| Engine Speed (n) | Emissions limits NO _x [g/kWh] |
|----------------------------------|---|
| <i>n < 130 rpm</i> | 17.0 |
| <i>130 rpm ≤ n < 2000 rpm</i> | <i>45 / n^{0.2}</i> |
| <i>n ≥ 2000 rpm</i> | 9.8 |

4. NO_x reduction

4.1. Intake air humidification

Of the different approaches for introducing water into the combustion chamber, humidifying the intake air has the potential to provide the greatest reductions in NO_x. Water/fuel (W/F) ratios from 1 to 3 are possible (depending on charge air temperature) with this approach if the energy for water evaporation is provided by waste engine heat from either the exhaust or the cooling system.

A number of approaches for intake air humidification have been attempted. While there are some differences in the approaches, the most successful intake air humidification systems take significant steps to ensure that only water vapor enters the cylinder and that liquid water does not carry over into the cylinder and cause cylinder liner corrosion problems. In order to get high NO_x reductions,

This often means that the humidity of the air is near saturation as it enters the engine and that the intake manifold air temperature is as high as the engine can tolerate.

Munters has the propriety of the first intake air humidification system, named the Humid Air Motor (HAM).

The basic design and principles of the *Munters* Humid Air Motor is described in one of their patents. Next figure shows a diagrammatic of the HAM. A humidification tower is placed between the intake air compressor and the engine. Water that is pre-heated with waste engine heat is sprayed from nozzles at the top of the column into the air flow entering from the bottom. An amount of water far in excess of that required to saturate the air is supplied. Only 5% to 10% of the water sprayed into the tower evaporates. Water that does not evaporate into the air is collected at the bottom and re-circulated. Supplying excess heated water accomplishes two things. It makes the system self-regulating. The amount of humidity added to the intake air, assuming that the tower is sufficiently sized to allow saturation of the air, is governed by the temperature and pressure of the air during the humidification process. The excess heated water also provides heat for the evaporation process. This minimizes the temperature drop of the air in the humidification tower ensuring that the humidity of the air stays as high as possible. Also by supplying excess water that has been pre-heated from waste engine heat, use of steam that would otherwise need to be generated from higher temperature heat sources can be avoided.

The HAM process designed by *Munters* was first bench tested on a MAN B&W 3V40/50 prototype 4 stroke medium speed diesel engine in the research and development facilities of S.E.M.T. *Pielstick* in-service verification was carried out in co-operation with Viking Line on one engine (12 PC2.6, 5,750 kW) onboard the RoRo ferry "*Mariella*" operating in the Baltic Sea. The HAM system was installed on main engine No. 1 in the summer of 1999. NO_x reductions of 60 % were claimed with a final certification value of 4.4 g/kWh NO_x. The humidification vessel is 4 m long, 1.4 m in diameter and has 3 humidifier stages which humidify and cool the air from approximately 160 °C at the outlet of the compressor down to approximately 65-70 °C. The air reaches about 98 % relative humidity which corresponds to an absolute humidity in the range of 60 to 80 g water/kg dry air. Sea water is used and re-circulated until the salt content increases by about 6 %.

During the year 2000, *Marioff*, a developer of water mist systems for fire suppression, started to develop the Combustion Air Saturation System (CASS). The key to this system development is the spray nozzle and control system. Air and water in varying ratios are supplied to the nozzle providing water droplet sizes around 50 to 200 μm and W/F ratios from 0.5 to 2.5. The air/water ratio supplied to the nozzle is varied so that the water droplet size is a function of engine load with the smallest droplet sizes produced when the engine load is low and good evaporation is more difficult. Early in 2001, a press release was issued that stated that *Marioff* and Wärtsilä had formed a partnership. During 2001 and early 2002, full-scale engine tests were carried out at Wärtsilä in Finland. Reduction of NO_x to less than 3 g/kWh was claimed at the time for starting values of 10-15 g/kWh.

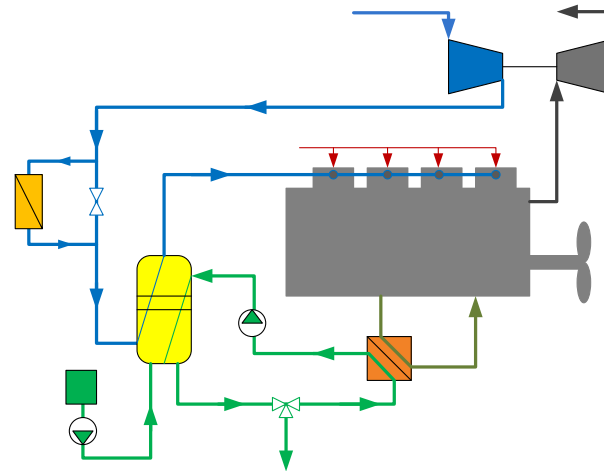


Fig. 2 Humid Air Motor System

4.2. Direct water injection

This method of NO_x reduction can be carried out with two slightly different variations by injecting water directly into the cylinder head via a separate nozzle, or by alternating fuel and water through a specially designed nozzle. Both of these techniques for adding water are based on the same fundamental concept: injecting water into the system at the combustion cylinder reduces high peak temperatures, which in turn reduces NO_x formation.

The primary benefit of injecting water directly into the cylinder through a separate nozzle is that both the amount of water and the timing that the water is injected are variable and can be controlled separately from the fuel. Similarly, the amount of water injected in sequence with fuel from a single nozzle can be varied although the timing of injection is dependent on the W/F ratio. In general, these methods allow for substantial amounts of water to be added to the system, which can, in turn, lead to large reductions in NO_x emissions. Another attribute of direct water injection into the cylinder is that liquid water can usually be directed towards the flame more efficiently.



Fig.3 Combined Nozzle Used by Wärtsilä

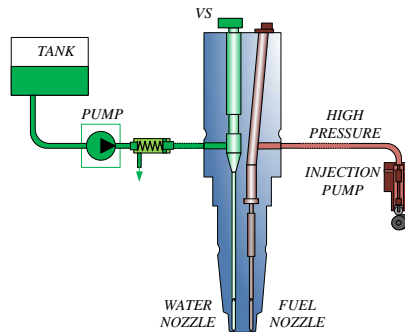


Fig.4 Wärtsilä combined injector

Current DWI systems by *Wärtsilä* boast NO_x emission reduction of 50-60 % (without adversely effecting power output), which translates to 4-6 g/kWh of NO_x (for Marine Diesel Oil) and 5-7 g/kWh (for Heavy Fuel Oil). The system typically operates at a W/F ratio of 0.40 to 0.70.

The *Wärtsilä* technique for DWI also allows for water shut-off, as the water system is controlled separately from the fuel, so that the engine can be operated with or without water injection. *Wärtsilä* claims that both investment and operational costs are low and that space requirements for the system is minimal, allowing for easy installation.

4.3. Saturation air motor

The SAM system for saturation and cooling of the compressed air from the compressor side of the turbocharger has been tested from an engine performance point of view on the 4T50ME-X research engine. The tests gave promising results with regard to the ability of reducing NO_x emissions. However, long-term influence of the SAM system on engine components as well as operation with a salt content of up to 3.5% could not yet be investigated.

The SAM system has a sea water injection stage, where a surplus of sea water is injected for saturation and cooling of the hot air from the compressor. The sea water stage will provide a near 100% humidification of the scavenge air and supply all of the water for humidification.

The freshwater stages 1 and 2 will be near temperature neutral to the scavenge air and create a small freshwater production depending on the operation parameters chosen. The freshwater stages only act as cleaning stages for removal of any salt which may pass with the air from the sea water stage. A continuous accumulation of salt in the freshwater stages would eventually cause the salt content to reach an unacceptably high level. This is counteracted by cooling the saturated air with the air cooler and generating some extra freshwater for stage 2. The extra freshwater is then sent upstream on the tank side of the SAM system, as illustrated in the figure. Thereby the content of salt in the freshwater stages can be controlled.

A vital aspect in ensuring that no or a minimum of salt gets into the engine is a good efficiency of the water drainage. All the water drainage systems are, subsequently, based on the slung principle followed by mechanical water separation in metal foam. Measurements on a small pilot plant has indicated an efficiency as high as 99.6% with this solution. The efficiency of the water drainage for the sea water and fresh water stages is 99%.

It is also a function of the time the nitrogen and the excess oxygen are exposed to the high temperatures associated with the diesel engine's combustion process. In other words, the higher the combustion temperature (e.g., high peak pressure, high compression ratio, high rate of fuel delivery, etc.), the greater the amount of NO_x formation. A low-speed diesel engine, in general, tends to have more NO_x formation than a high-speed engine. NO_x has an adverse effect on the environment, causing acidification, formation of ozone, nutrient enrichment, and contributes to adverse health effects globally.

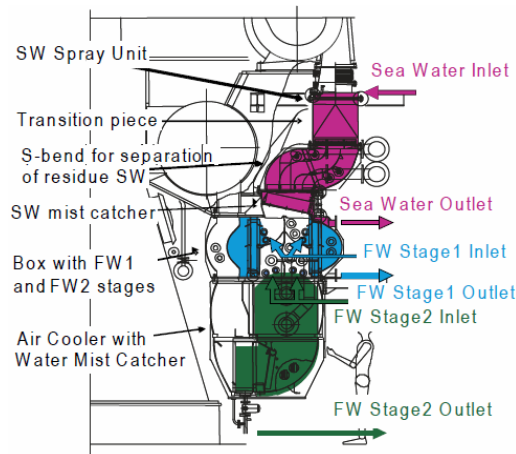


Fig.5 S.A.M. System

5. Conclusions

The primary mechanisms for NO_x formation during combustion are Thermal NO, Prompt NO, N₂O Pathway, and Fuel Nitrogen Pathway. Process parameters that influence NO_x formation (i.e., quantity of reactants, pressure, temperature, etc.) may effect a change in the quantity of NO_x formed.

Much of the current understanding regarding diesel combustion, NO_x formation and reduction mechanisms is based on heavy-duty, high-speed diesel engines using distillate fuels. Less attention has been given to medium- and low-speed marine diesel engines burning heavy fuels. The nature of combustion in medium- and low-speed diesel engines operating on heavier fuels can differ from high-speed engines operating with on-road diesel fuel. However, it is expected that the mechanisms of charge dilution with water used to lower NO_x emissions will be similar. The reduction in the flame temperature due to the reduced mole fraction of oxygen and subsequent increase in the mole fraction of relatively inert heat absorbing gases is expected to be most important. This will be most apparent on NO_x formed by the thermal mechanism.

Water-based NO_x reduction methods introduce water vapour into the combustion process, which affects the various NO_x formation mechanisms. The primary effects are a reduction in combustion temperature (via heat of vaporization of water) and stoichiometric change brought about by mass dilution of the combustion constituents (e.g., oxygen and nitrogen starvation).

Of the water-based technologies investigated, intake air water injection / humidification appears to provide the greatest potential for NO_x reduction. Sophisticated system implementations (CASS, HAM) using W/F ratios in the range of 2.5 to 4.5 are able to obtain NO_x reductions in range of 60 to 80%.

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M-FUNCTIONS THAT COMPUTE THE BESSEL FUNCTIONS OF THE FIRST KIND J_ν AND SECOND KIND Y_ν WITH ν INTEGER

Paul VASILIU¹

¹ Ph.D. Lecturer Naval Academy “Mircea cel Batran”, Constanta

Abstract: In mathematics, Bessel functions, first defined by the mathematician Daniel Bernoulli and generalized by Friedrich Bessel, are canonical solutions $y(x)$ of Bessel's differential equation $x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - \nu^2)y = 0$ for an arbitrary real or complex number ν , the order of the Bessel function. The most common and important special case is where ν is an integer. The OCTAVE package is the free implementation of the MATLAB package. In OCTAVE package we can find the functions `besselj` and `bessely`. With their help we can compute the values of the Bessel functions of the first kind J_ν and second kind Y_ν with ν noninteger. In this work I present two M-functions for computing the values of Bessel functions of the first kind J_ν and second kind Y_ν with ν integer.

Keywords: Bessel functions, m-function, integer, noninteger, order

1. Introduction

The well known differential equation:

$$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - \nu^2)y = 0 \quad (1)$$

where ν is a real constant, is called Bessel's equation, and its solutions

$$J_\nu(x) = \sum_{k=0}^{\infty} \frac{(-1)^k}{\Gamma(k+1)\Gamma(k+\nu+1)} \left(\frac{x}{2}\right)^{2k+\nu} \quad (2)$$

and

$$J_{-\nu}(x) = \sum_{k=0}^{\infty} \frac{(-1)^k}{\Gamma(k+1)\Gamma(k-\nu+1)} \left(\frac{x}{2}\right)^{2k-\nu} \quad (3)$$

are called Bessel functions of the first kind. They form a fundamental set of solutions of Bessel's equation for noninteger ν , where Γ is the Euler Gamma function. It can be computed by using OCTAVE `besselj` function only if ν is noninteger.

If $\nu = n \in \mathbb{Z}$ we have:

$$J_n(x) = (-1)^n \cdot J_{-n}(x) \quad (4)$$

To define a Bessel function with integer values for n it can be also used the integral representation:

$$J_n(x) = \frac{1}{\pi} \int_0^\pi \cos(n\tau - x \sin \tau) d\tau \quad (5)$$

If $\nu \notin \mathbb{Z}$, the function:

$$Y_\nu(x) = \frac{1}{\sin(\nu\pi)} \cdot (J_\nu(x) \cdot \cos(\nu\pi) - J_{-\nu}(x)) \quad (6)$$

is the second solution of Bessel's equation which is linearly independent of J_ν . It can be computed by using OCTAVE `bessely` function with ν noninteger.

If $\nu = n \in \mathbb{Z}$, we have $Y_n(x) = \lim_{\nu \rightarrow n} Y_\nu(x)$ with the following result in integral form:

$$Y_n(x) = \frac{1}{\pi} \cdot \int_0^\pi \sin(x \cdot \sin(t) - n \cdot t) dt - \frac{1}{\pi} \cdot \int_0^\infty (e^{n \cdot t} + (-1)^n \cdot e^{-n \cdot t}) \cdot e^{-x \cdot \sinh(t)} dt \quad (7)$$

Bessel's equation arises when finding separable solutions to [Laplace's equation](#) and the [Helmholtz equation](#) in [cylindrical](#) or [spherical coordinates](#). Bessel functions are therefore especially important for many problems of [wave propagation](#) and static potentials. In solving problems in cylindrical coordinate systems, one obtains Bessel functions of integer order $\nu = n$; in spherical problems, one obtains half-integer orders $\nu = n + \frac{1}{2}$. For example: electromagnetic waves in a cylindrical [waveguide](#), heat conduction in a cylindrical object, modes of vibration of a thin circular (or annular) [artificial membrane](#) (such as a [drum](#) or other [membranophone](#)), diffusion problems on a lattice. Bessel functions also have useful properties for other problems, such as signal processing.

In this work I describe two m-functions for computing the values of Bessel functions of the first kind J_ν and second kind Y_ν with ν integer. In the second section I emphasize the m-functions called `besselz`, `besselJ`, `besselYZ` and `besselY` which are used to compute the values of Bessel functions of the first kind J_ν and the second kind Y_ν with ν integer. In the last section I intend to present a comparison between a few results obtained with the OCTAVE functions like `besselj`, `bessely`, and the results achieved with `besselJ` and `besselY` functions.

2. M-Functions

Using integral representation (5) the m-function with the prototype `int=besselz(n,x)` computes the values of the Bessel function $J_\nu(x)$ for $\nu = n \in \mathbb{Z}$ in x point. The function calls the OCTAVE function `quad` to approximately compute the integral from (5). The code follows:

```
function int=besselz(n,x)
y=@(tau)cos(n*tau-x*sin(tau));
int = (1/pi)*quad(y,0,pi);
```

Using (2), (3) formulas and the m-function `besselz`, the m-function with the prototype `y=besselJ(nu,x)` computes the values of the Bessel function $J_\nu(x)$ for noninteger or integer, scalar or vector ν (V), in x which can be scalar or vector.

In order to ascertain the function's values in x point (or $x(i)$ if x is vector) with ν determined and noninteger (or $\nu(i)$ noninteger, only if ν is vector), we have computed the partial sum of the function's series (2),(3). The compute of the sum stops when the absolute value of the general term becomes less than `eps=0.00001`. For ν integer (or $\nu(i)$ noninteger, if ν is vector) we have used the real integral representation (5). The function calls the OCTAVE function `quad` to approximately compute the integral (5).

If x and ν are vectors, the function builds and returns the same matrix y of the Bessel's function values of the first kind not only for the call with the x parameter, but also for the call of the x' parameter.

If x is vector and not scalar the function builds and returns the y vector (line vector).

If x and ν are both scalar the function builds and returns the value of the y scalar. The calls of the `besselJ(nu,x)` and

OCTAVE `besselj(nu,x')` have the same result. The code follows:

```
function y=besselJ(nu,x)
[ma na]=size(nu);
[mx nx]=size(x);
eps=0.00001;
if mx ~= nx & ma ~= na           % x and nu vectors      n=na;
if nx ~= 1
m=nx;
else
m=mx;
end
for ia=1:n
for ix=1:m
if floor(nu(ia)) ~= nu(ia)      % nu(ia) noninteger
s=0;
j=0;
while abs((((-1)^j)/(gamma(j+1)*gamma(j+nu(ia)+1)))*((x(ix)/2)^(2*j+nu(ia)))) > eps
s=s+((((-1)^j)/(gamma(j+1)*gamma(j+nu(ia)+1)))*((x(ix)/2)^(2*j+nu(ia)))));
j=j+1;
end
y(ix,ia)=s;                    % y matrix
else                            % nu(ia) integer
y(ix,ia)=besselz(nu(ia),x(ix));
end
end
end
if mx ~= nx & ma==na           % x vector and nu scalar
m=nx;
for ix=1:m
if floor(nu) ~= nu            % nu noninteger
s=0;
j=0;
while abs((((-1)^j)/(gamma(j+1)*gamma(j+nu+1)))*((x(ix)/2)^(2*j+nu))) > eps
s=s+((((-1)^j)/(gamma(j+1)*gamma(j+nu+1)))*((x(ix)/2)^(2*j+nu)));
j=j+1;
end
y(ix)=s;                      % y vector
else                            % nu integer
y(ix)=besselz(nu,x(ix));
end
end
end
if mx==nx && ma==na           % x scalar and nu scalar
```

```

if floor(nu) ~= nu % nu noninteger
s=0;
j=0;
while abs((((-1)^j)/(gamma(j+1)*gamma(j+nu+1)))*((x/2)^(2*j+nu))) > eps
s=s+((((-1)^j)/(gamma(j+1)*gamma(j+nu+1)))*((x/2)^(2*j+nu)));
j=j+1;
end
y=s;
else % nu integer
y=besselz(nu,x);
end
end

```

Using integral representation (7), the m-function with the prototype `int=besselYZ(n,x)` computes the values of the Bessel function $Y_\nu(x)$ for $\nu = n \in Z$ in x point. The code follows:

```

function int=besselYZ(n,x)
y=@(t)sin(x*sin(t)-n*t);
int1 = (1./pi)*quad(y,0,pi);
y=@(t)(exp(n*t-x*sinh(t))+(-1)^n*exp(-n*t-x*sinh(t)));
int2=(1./pi)*quad(y,0,100000);
int=int1-int2;

```

Using (6), m-function `besselJ` and m-function `besselYZ`, m-function with the prototype `y=besselY(nu,x)` computes the values of the Bessel function $Y_\nu(x)$ for noninteger or integer, scalar or vector ν (V), in x which can be scalar or vector.

The function `y=besselY(nu,x)` computes the values of the Bessel function of the second kind and ν order in x point ($Y_\nu(x)$), values that are stored by `y`.

In order to compute the values of the Bessel function of the second kind we call the function `y=besselJ(nu,x)` and make the difference between two cases: when ν is integer and noninteger. For ν noninteger we used the equation (6) and for ν integer we used the m-function with the prototype `int=besselYZ(n,x)`, that was inferred from the boundary compute from the definition of the Y_ν , with V integer.

If x and ν are vectors, the function builds and returns the same matrix `y` of the Bessel's function values, function of the second kind, not only for the call of the x parameter but also for the call of the ν parameter.

If x is a vector and ν a scalar the function builds and returns the line vector `y`. If x and ν are both scalars the function returns the value of the `y` scalar.

The calls `besselY(nu,x)` and `bessely(nu,x')` have as result the same values if ν does not have integer component parts. The code follows:

```

function y=besselY(nu,x)
[ma na]=size(nu);
[mx nx]=size(x);
if mx ~= nx & ma ~= na % x and nu vectors
n=na;
if nx ~= 1
m=nx;
else
m=mx;
end
for ia=1:n
for ix=1:m
if floor(nu(ia)) ~= nu(ia) % nu noninteger
y(ix,ia)=(1./sin(pi*nu(ia)))*(besselJ(nu(ia),x(ix))*cos(pi*nu(ia))-besselJ(-nu(ia),x(ix)));
else % nu integer
y(ix,ia)=besselYZ(nu(ia),x(ix));
end
end
end
end
if mx ~= nx & ma==na % x vector and nu scalar
m=nx;
for ix=1:m
if floor(nu) ~= nu % nu noninteger
y(ix)=(1./sin(pi*nu))*(besselJ(nu,x(ix))*cos(pi*nu)-besselJ(-nu,x(ix)));
else % nu integer
y(ix)=besselYZ(nu,x(ix));
end
end
end
if mx==nx && ma==na % x scalar and nu scalar
if floor(nu) ~= nu % nu noninteger
y=(1./sin(pi*nu))*(besselJ(nu,x)*cos(pi*nu)-besselJ(-nu,x));
else % nu integer

```

```
y=besselYZ(nu,x);
end
end
```

3. Numerical results

In this section I compute several values of the Bessel functions J_ν and Y_ν by using , on one hand, OCTAVE functions `besselj` and `bessely`, and, on the other hand, the m-functions defined in section 2, `besselJ` and `besselY`. I have taken into consideration the following possibilities:

The case `nu` and `x` scalars and `nu` noninteger:

```
>> besselj(0.5,0.5)      >> besselJ(0.5,0.5)
ans =                    ans =
  0.5410                  0.5410
>> bessely(0.5,0.5)    >> besselY(0.5,0.5)
ans =                    ans =
 -0.9902                 -0.9902
```

The case when `nu` and `x` are vectors with the same size and `nu` noninteger:

```
>> nu=[0.1:0.1:0.5]
nu =
  0.1000  0.2000  0.3000  0.4000  0.5000
>> x=nu
x =
  0.1000  0.2000  0.3000  0.4000  0.5000
>> besselj(nu,x)
ans =
  0.7773  0.6815  0.6198  0.5753  0.5410
>> besselJ(nu,x)
ans =
  0.7773  0.5970  0.4527  0.3394  0.2519
  0.8274  0.6815  0.5541  0.4455  0.3544
  0.8518  0.7313  0.6198  0.5193  0.4305
  0.8626  0.7633  0.6666  0.5753  0.4913
  0.8638  0.7830  0.7003  0.6188  0.5410
>> bessely(nu,x)
ans =
 -1.6824 -1.3492 -1.1783 -1.0687 -0.9902
>> besselY(nu,x)
ans =
 -1.6824 -1.8304 -2.0019 -2.2202 -2.5105
 -1.2237 -1.3492 -1.4703 -1.5993 -1.7486
 -0.9483 -1.0693 -1.1783 -1.2831 -1.3917
 -0.7457 -0.8659 -0.9718 -1.0687 -1.1620
 -0.5823 -0.7024 -0.8080 -0.9027 -0.9902
```

The case when `nu` and `x` are vectors but have don't have the same size, with `nu` integer:

```
>> nu=[0:1:2]
nu =
  0  1  2
>> x=[0.1:0.1:0.5]
x =
  0.1000  0.2000  0.3000  0.4000  0.5000
>> besselJ(nu,x)
ans =
  0.9975  0.0499  0.0012
  0.9900  0.0995  0.0050
  0.9776  0.1483  0.0112
  0.9604  0.1960  0.0197
  0.9385  0.2423  0.0306
>> besselY(nu,x)
ans =
 -1.5342 -0.6345 -127.6448
 -1.0811 -0.6282 -32.1571
 -0.8073 -0.6176 -14.4801
 -0.6060 -0.6030 -8.2983
 -0.4445 -0.5844 -5.4414
```

In the following lines I have graphical represented the functions J_0 , J_1 , J_2 in the same axis (Chart 1), Y_0 , Y_1 , Y_2 in the same axis (Chart 2), J_0 and Y_0 (Chart 3) and J_1 and Y_1 (Chart 4). For this purpose I defined the Bessel m-function with prototype `[y1,y2]=bessel(nu,x)`.

The m-function with prototype `[y1,y2]=bessel(nu,x)` draws the graphic of the linear independent solutions of the Bessel equation. It is well known that for any `nu` the Bessel functions of the first kind and `nu` order J_ν and of the second kind with ν order Y_ν are linear independent.

The function draws in the same axis system two linear independent solutions J_ν and Y_ν of the Bessel equation when ν is fixed.

The function calls `besselJ` and `besselY` functions to build the `y1` and `y2` vectors if `nu` parameter is scalar. If `nu` parameter is vector, then function build the matrix `yb1` and `yb2`. The code follows:

```
function [y1,y2]=bessel(nu,x)
```

```

y1=besselJ(nu,x);
y2=besselY(nu,x);
[ma,na]=size(nu);
if ma==na                                % nu scalar
    plot(x,y1,'k',x,y2,'k');
    axis([0 20 -1 1]);
else
if na ~= 1
    n=na;
else
    n=ma;
end                                        % nu vector
for j=1:n
    yb1=y1(:,j);
    yb2=y2(:,j);
    plot(x,yb1,'k',x,yb2,'k');
    axis([0 20 -1 1]);
    pause;
end
end
    
```

The results of the execution are the charts 1 and 2.

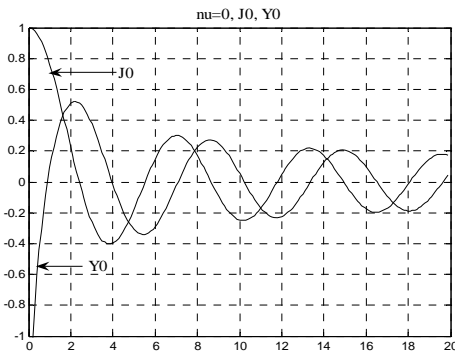


Chart 1 The functions J_0 and Y_0

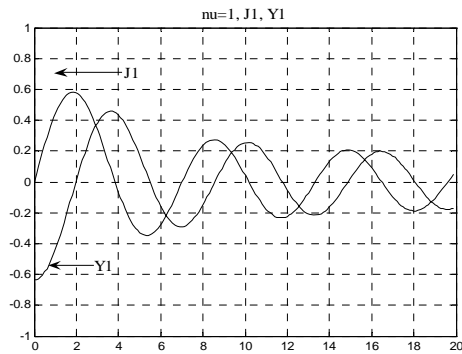


Chart 2 The functions J_1 and Y_1

The m-function with prototype function [y1,y2]=bessel(nu,x) is used for graphical representation of the J_0 , J_1 and J_2 functions.

```

function [y1,y2]=bessel(nu,x)
y=besselJ(nu,x);
[ma,na]=size(nu);
if na ~= 1
    n=na;
else
    n=ma;
end
hold on;
for j=1:n
    yb=y(:,j);
    plot(x,yb,'k');
    pause;
    axis([0 20 -1 1]);
end
end
    
```

The results of the execution are the chart 3.

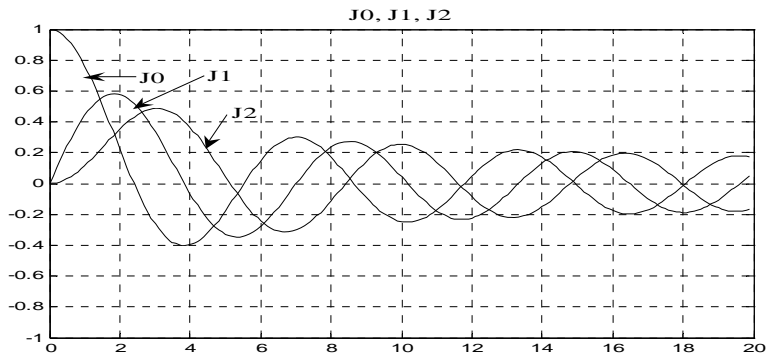


Chart 3 The functions J_0, J_1, J_2

The m-function with prototype function $[y1,y2]=\text{bessel}(\text{nu},x)$ can also be used by changing the line $y=\text{besselJ}(\text{nu},x)$ with the line $y=\text{besselY}(\text{nu},x)$, for graphical representation of the Y_0, Y_1 and Y_2 functions. The results of the execution are the chart 4.

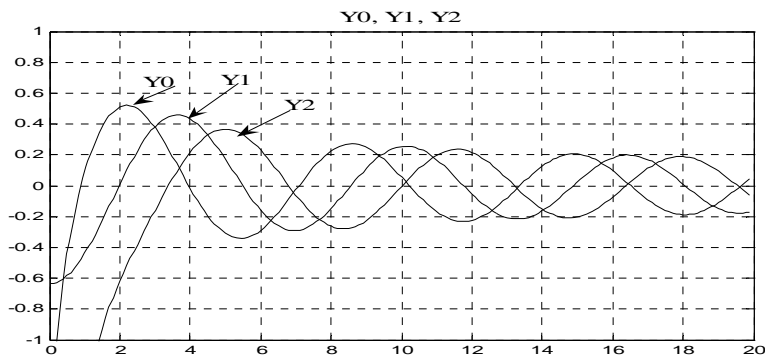


Chart 4 The functions Y_0, Y_1, Y_2

4. Conclusions

In this paper I have defined two m-functions with the prototypes $y=\text{besselJ}(\text{nu},x)$ and $y=\text{besselY}(\text{nu},x)$. These two functions generalize from two points of view the OCTAVE m-functions `besselj` and `bessely`. We take into consideration the situation when the `nu` parameter of the `besselJ` and `besselY` functions might be integer, but this fact can't be allowed for the `besselj` and `bessely` functions.

In the case when `nu` and `x` are vectors, the functions `besselj` and `bessely` require the same size for both of the vectors `nu` and `x`. If vector `nu` has the components `nu(i)` with $i=1,2,\dots,n$, and vector `x` with the components `x(i)` where $i=1,2,3,\dots,n$, the functions `besselj` and `bessely` compute the values of the `besselj(nu(i),x(i))` and `bessely(nu(i),x(i))`. The functions `besselJ` and `besselY` remove the requirement that the vectors `x` and `nu` have the same size. If vector `nu` has the components `nu(i)` with $i=1,2,\dots,n$, and vector `x` has the components `x(j)` with $j=1,2,\dots,m$, the m-functions `besselJ` and `besselY` compute the values of `besselJ(nu(i),x(j))` and `besselY(nu(i),x(j))` having as result the matrix `y`.

The obtained results in the considered examples prove that the pairs of functions `besselj`, `besselJ` and `bessely`, `besselY` have the same result with the `nu` parameter noninteger.

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CONSIDERATIONS REGARDING THE LOW - SULPHUR FUEL OPERATION OF DIESEL ENGINES

Sebastian ZĂICEANU¹
Adrian TRIFAN²

¹ Lt(r). drd. ing. Academia Tehnică Militară din București și Academia Navală Mircea cel Bătrân

² Lt(r). drd. ing. Academia Tehnică Militară din București și Academia Navală Mircea cel Bătrân

Abstract: Today, we have ECAs (emission control areas) based on EU and IMO regulations, in the Baltic Sea, the North Sea and the English Channel. And more such areas are expected to come. In the USA, the EPA (Environmental Protection Agency) is considering to designate Long Beach an ECA very soon. The sulphur content has an impact on the sulphur acid emission to the air, sea

and land, as well as a major impact on the particle level in the exhaust gas.

Keywords: pollution, fuels, water, burning

1. Introduction

Ultra-low sulfur diesel fuel (ULSD) is, as the name suggests, a particularly “clean” form of diesel fuel. Its use reduces formation of SO_x emissions, but does not markedly change NO_x production. The low sulfur fuel allows the use of after-treatment emission-reduction devices (NO_x absorber, Oxidation Catalyst, etc.) that are otherwise poisoned by the sulfur emissions (SO_x) in the exhaust. Use of low sulfur fuels may serve as an interim measure for diesel prime movers provided compatible lubricants are available for high-speed diesel engines.

2. Regulations

There are a number of national and international regulatory organizations that propose limitations on NO_x as well as other harmful emissions. The International Maritime Organization (IMO), through the International Convention for the Prevention of Pollution from Ships (MARPOL, Annex VI) regulates this on a global level. They have developed an approach to reducing green house gas (GHG) emissions, including NO_x. Member countries of the IMO must therefore adhere to the regulations that they have put forth. However, some organizations have committed to adopting regulations that are more stringent.

Annex VI and the Technical Code of MARPOL 73/78 adopted in September 1997 has two significant implications for ship operators. Firstly, it specifies that the sulphur content of fuel oil must not exceed 4.5% m/m world wide, or 1.5% m/m for ships operating within SO_x Emission Control Areas. Secondly, and perhaps more importantly, it specifies that diesel engines for new ships constructed and for new installations after 1 January 2000, the generation of NO_x will be restricted within the following limits:

- 17.0 g/kWh when the maximum engine speed is less than 130 rpm;
- $45.0 \cdot n^{-0.2}$ g/kWh when the maximum engine speed (n) is more than 130 but less than 2000 rpm;
- 9.8 g/kWh when the maximum engine speed is greater than 2000 rpm.

This restriction is summarised by the graph in Figure 2.1 and is based on the total calculated weighted NO_x emissions. The calculated weight is based on the relevant test cycle, (i.e. based on the role and purpose of the engine) and measurement methods specified by the Technical Code, for MDO operations under ISO conditions.

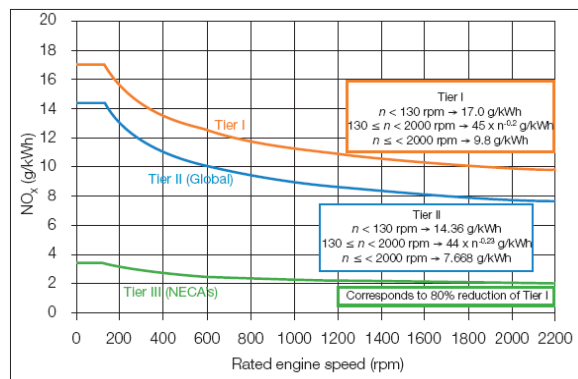


Fig.1. NO_x emissions limits

3. Emissions

The major pollutants in diesel exhaust emissions are a direct result of the diesel combustion process itself. In general, the major components are as shown in Figure 2. While the type of fuel used plays a major part in determining the composition of the emissions, an important factor that determines the amount of NO_x, is engine speed (the real factor is residence time). In way of comparison, Table 1 demonstrates typical emissions values for low and medium speed engines.

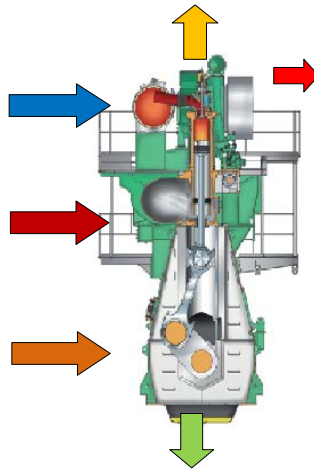


Fig.2 Emissions resulted from the diesel engine

AIR
 21%O₂
 79%N₂

Table 1

| Pollutant | Medium Speed Engines (g/kWh) | Low Speed Engines (g/kWh) |
|----------------------------------|---------------------------------|------------------------------|
| NO _x | 12.0 | 17 |
| CO | 1.6 | 1.6 |
| HC | 0.5 | 0.5 |
| CO ₂ | 600 | 600 |
| SO ₂ | 3.6 · %S | 3.6 · %S |
| where S = sulphur content (%m/m) | | |

FUEL
 97%HC
 3%O₂
 3%S

4. Sulphur Oxides

The formation of Sulphur Oxides (SO_x) in exhaust gases is caused by the oxidation of the sulphur in the fuel into SO₂ and SO₃ during the combustion process. As indicated in Table 1, the amount of SO_x formed is a function of the sulphur content of the fuel used and therefore the only effective method of reducing SO_x is by reducing the sulphur content of the fuel. Unfortunately, low-sulphur fuels are more expensive to purchase (10 to 20% greater cost, when switching from 3.5% to 1% sulphur) and there is a practical lower sulphur limit desired as desulphurisation of fuel lowers the lubricity of the fuel which can lead to increase wear on fuel pumps and injectors.

The regulation of SO_x is predominately a regional issue. However, international pressure is growing for the oil producers to reduce the sulphur content of all fuels in order to control this problem at the source. The current EU Directive, which applies to all gas oil sold on land in the EU, is that the % sulphur content of fuels must remain below 0.2% with the aim of reducing this limit to 0.1% by the year 2010. Presently, most military navies use 1% low-sulphur fuels or lower. Special Areas have been set up, such as the Baltic, where the use of low sulphur fuels will be mandatory when Annex VI is ratified and will be limited to 1.5%.

If required, desulphurisation of diesel exhaust gases can be achieved by wet scrubbing. The flue gas is first passed through a quencher where it is cooled down to saturation temperature. The SO_x is subsequently washed out with a neutralising agent (calcium bound in lime-milk or seawater) in a scrubber, however additional costs are incurred in disposing of the scrubbing products.

SO_x formed from diesel exhaust is corrosive and in part is neutralised by an engines lubricating oil which is typically base. In the atmosphere however, SO_x combines with moisture to form H₂SO₄, which then falls as acid rain, and has been linked to environmental damage.

5. Low-sulphur fuel operation

Even though modern two-stroke engines are largely insensitive to the fuel quality, changing between fuels with different levels of viscosity is an important consideration to make.

The cylinder lube oil base number must be considered. Operating on normal BN 70 cylinder oil (usually used by MAN B&W Diesel Engine) for too long when burning low-sulphur fuel will create a situation where the corrosion on the cylinder liners becomes too small and uncontrolled. The result is a creation of an excess of additive-generating deposits in the combustion chamber. Low-BN oil is available from the major oil companies, and recommendation on the use of low and high-BN oils are also available.

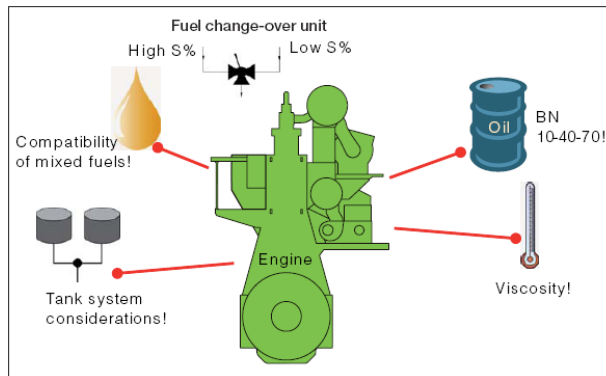


Fig.3 Low-sulphur fuel operations

The fuel change-over process must follow the thermal expansion of both the fuel pump plunger and the barrel, and a procedure has been created to avoid causing damage to the fuel pumps. Furthermore, an automatic change-over unit will be available later this year.

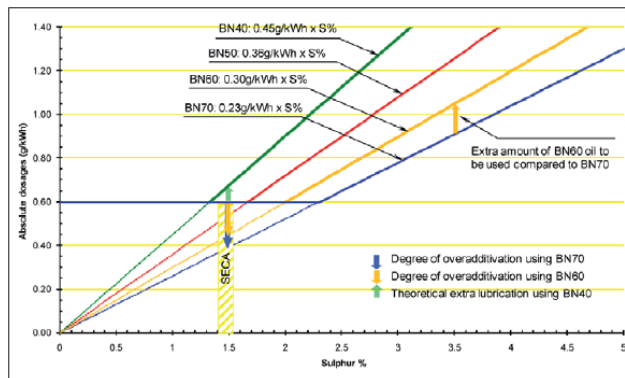


Fig 4. Low-sulphur fuel operations, choice of cylinder lube oil

In order to ensure the creation of a hydrodynamic oil film between the fuel pump plunger and barrel, a viscosity of 2 cSt is required at the engine inlet. This may be difficult to achieve for some DO and GOs, and some operators may have to introduce a cooler in the fuel oil system to ensure a satisfactory viscosity level.

The ignition quality of a fuel oil is not an issue for modern two-stroke engines. Companies has conducted a number of research tests showing that the their two-stroke engine is insensitive to the poor ignition quality fuels on the market today.

6. Conclusions

It is inevitable that the exhaust gas emission from marine engines will be further regulated, and we expect that many new engines, and especially existing engines, will eventually have to be operated on low-sulphur fuel. This will be the case even though exhaust gas scrubbers and/or emission trading have become possible by the time new regulations are introduced. On the two-stroke engines built in 2008-2009, no difference in the engine performance is considered between DO/GO and HFO operation, where the HFO used today has a sulphur content of 2.7% on average. However, operators have to take the necessary precautions, and the marine industry has to consider what general application the new low-sulphur fuels are being designed for, especially with regard to the fuel compatibility between fuels, and ignition qualities.

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IMO REGULATIONS ON LIFE-SAVING APPLIANCES

Oana ADĂSCĂLIȚEI¹

¹ Asistent univ.dr., Universitatea Maritimă din Constanța, Constanța, 900663, Romania

Abstract: *This Article aims to trace the evolution of the legal process relating to life-saving appliances starting with the first version of SOLAS Convention of 1914 up to the latest major legal amendment of chapter III SOLAS in 1998. As both the SOLAS Convention and the LSA Code are at present undergoing a wide review process, the role of the Maritime Safety Committee (MSC) and of the Sub-Committee on Ship Design and Equipment (DE) respectively will be presented with respect to the adoption of circulars relating to life-saving appliances.*

Key words: *life-saving appliances, SOLAS Convention, LSA Code*

Introduction

There will always be a risk of marine accidents, but being prepared for such events could make a difference for lives lost vs. lives saved. Life-saving appliances and procedures for ship abandon are covered by International Convention for the Safety of Life at Sea (SOLAS) – the first version was adopted in 1914 when marine nations gathered to draw up safety regulations for ship safety after the loss of Titanic 2 years before. SOLAS, which since 1914 has been revised and updated several times, entered the auspices of UN and IMO when it took global responsibility for the safety of maritime shipping on its first gathering in 1959. [1]

The current review of SOLAS Chapter III and the LSA Code uses a goal-based approach setting objectives (including:

escape, survival, notification of distress and rescue), as well as functional requirements (including: communication; personal life saving; mass evacuation; as well as searching and salvage operations). The intention is to aim at the proactive identification and risk assessment as a distinct form of traditional approach and a perspective of regulation. The last comprehensive review of SOLAS chapter III was finalized when a revised chapter and the Life International-Saving Appliance (LSA) Code were adopted in 1996. They entered into force on 1 July 1998 and a large number of modifications have been made on both instruments ever since [x]. The amendments are the result of the activity carried out by the Maritime Safety Committee and the Sub-Committee on Ship Design and Equipment (DE) respectively. [1]

International Convention for the Safety of Life at Sea (SOLAS) 1914 SOLAS

The 1914 SOLAS convention was signed on the 20 January 1914 by 13 countries and considered many of the lessons learned from the disaster of the Titanic – moreover, it settled the rules applicable on an international level for the first time. The Convention contained eight chapters: Chapter I - Safety of Life at Sea; Chapter II - Ships to which this Convention applies; Chapter III - Safety of Navigation; Chapter IV - Construction; Chapter V - Radiotelegraphy; Chapter VI - Life-saving appliances and fire protection; Chapter VII - Safety Certification; Chapter VIII - General; The 1914 SOLAS also includes a section of the regulations referring to the technical aspects and the extension of articles. [1] Chapter VI of the 1914 SOLAS Convention, in Article 40 called “Fundamental Principle”, approached the issue of the insufficient number of life boats onboard the

Titanic stating that “at no moment of her journey can a ship have onboard a total number of persons greater than the number of life boats (and the pontoon lifeboats) provided. It is also mandatory for lifejackets to be carried for every person on board (Article 51), with a sufficient number of lifejackets for children, and included requirements for embarkation (Article 44) and stowage of lifeboats and liferafts (Article 47). [1]

The Convention required emergency lighting to be provided on ships (Article 53) and set regulations for manning of lifeboats by certificated lifeboatmen (Article 54). It called for special duties in the event of an emergency to be allocated to each member of the crew (Article 56 - Muster roll and Drills). The provisions of the Convention include technical specifications for lifeboats, pontoon lifeboats, davits, lifejackets and lifebuoys. The Convention requires musters of the crews at their boat and fire stations, followed by boat and fire drills, to be held at least once a fortnight. [1]

1929 and 1960 SOLAS

The outbreak of World War I meant that SOLAS 1914 did not enter into force as planned in 1915, although many of its provisions were adopted by individual nations. Nevertheless, in 1929, 18 countries took part in another international conference, which adopted a new SOLAS Convention. It entered into force in 1933. A third SOLAS Convention was adopted in 1948 - this was a greatly expanded version covering a wider variety of ships and went into greater detail in terms of the requirements. In particular, it required cargo ships of 500 gross tons and above to obtain a safety certificate - recognising the need to protect people on board cargo ships and not just those on passenger ships. In 1960, a new SOLAS Convention was adopted, this time by the recently founded International Maritime Organization, later called the Inter-Governmental Maritime Consultative Organization (IMCO). In SOLAS 1960, many safety provisions previously only applicable to passenger ships were also applied to cargo ships. [1] The Convention also took into account developments in liferafts and allowed for some of the lifeboats to be replaced by liferafts. The 1960 SOLAS Convention was more specific on the number of lifeboats to be carried - stating that passenger ships on international voyages should carry on each side of the ship lifeboat capacity for 50 percent of the total people on board, making a total capacity of 100%. Some boats could be replaced by liferafts. The Convention also required additional liferafts to

be provided for 25 percent of the people on board, plus buoyant apparatus for 3 percent. [1]

Amendments to the 1960 Convention adopted in 1967, 1969 and 1973 included updates to specification for lifebuoys and lifejackets as well as specific requirements for life-saving arrangements on tankers and certain cargo ships, many amendments being a response to specific accidents as well as updates accounting for technological changes. Unfortunately, it became increasingly apparent as the years went by that these efforts to respond to the lessons learnt from major disasters and keep the SOLAS Convention in line with technical developments were doomed to failure - because of the nature of the amendment procedure adopted at the 1960 conference. This stipulated that amendments would enter into force twelve months after being accepted by two thirds of Contracting Parties to the parent Convention. With a small number of Parties, this procedure was not a problem, but as more countries ratified SOLAS, the number of ratifications required to meet the two-thirds requirement needed to secure the entry into force of SOLAS amendments also increased. It became clear that it would take so long for these amendments to become international law that they would be out of date before entering into force. As a result, IMO decided to introduce a new SOLAS Convention which would not only incorporate all the amendments to the 1960 Convention so far adopted but would also include a new procedure making it possible for future amendments to be brought into force within an acceptable period of time. [1]

SOLAS 1974

An IMO Conference in 1974, attended by 71 countries, adopted a new revised SOLAS Convention, meant to incorporate all the amendments introduced since the 1960

Convention as well as a simpler amendment procedure - which assumes that Governments are in favour of the amendment unless they take positive action to make their objection known. The tacit acceptance procedure deems

amendments to have entered into force by a certain date unless rejected within a specified period by one third of Contracting Governments or by Contracting Governments whose combined merchant fleets represent not less than 50 per cent of world gross tonnage. [1]

Life-saving appliances came under Chapter III (Life-saving appliances) of the 1974 Convention, although many requirements were initially similar to those in the 1960

1983 Amendments to SOLAS

In 1983, IMO adopted a revised Chapter III, which entered into force in 1986, increasing the number of regulations from 38 to 53 and renaming the Chapter “Life-saving appliances and arrangements”. The main changes were to ensure operational readiness of ships and to guarantee as far as possible that after an incident, survivors could safely abandon ship, survive at sea, be detected and be retrieved by rescuers. The revisions were designed not only to take into consideration new developments but also to provide for the evaluation and introduction of novel life-saving appliances or arrangements. [1]

Similar to the original chapter, the revised chapter contained three parts, which were re-arranged logically. Part A dealt with general matters such as application, exemptions, definitions, evaluation and testing and production tests. Part B was concerned with ship requirements and contained three sections: Section I (provisions 6 to 19) dealt with passenger ships and cargo ships; Section II (regulations 20 to 25) contained additional requirements for passenger ships and Section III (regulations 26 to 29) included additional requirements for cargo ships. Part C dealt with life-saving appliance requirements and contained 24 regulations divided into eight sections. [1]

Among the more important changes were those referring to lifeboats and liferafts. Generally speaking, the lifeboats required by the original Chapter III of SOLAS 1974 were the traditional open design, most of them without power. The revised chapter required all lifeboats to be totally or partially enclosed, and for these to be equipped with an engine. The idea behind enclosed lifeboats was to provide greater protection from the elements than the traditional design. Partially enclosed lifeboats were included as they are easier to board in an emergency. This can be a crucial factor on a passenger ship where large numbers of untrained - or elderly, young or infirm - persons are involved. Partially enclosed lifeboats must have rigid covers extending over not less than 20% of the length from the stern and not less than 20% of the length from the aftermost part of the lifeboat and be equipped with a foldable canopy to protect the rest. [1] Totally enclosed lifeboats must be capable of righting themselves automatically if they capsize. Rescue boats - that is, boats which are designed to rescue persons in distress and to marshal survival craft - were also required. One important new requirement was that survival craft on

1998 SOLAS

In 1996 IMO adopted another completely revised version of Chapter III of SOLAS, taking into account the changes in technology since the chapter had last been revised in 1983. The new chapter entered into force on 1 July 1998 and applies to all ships built on or after that date, although some of the amendments also apply to existing ships. [1]

The chapter is made up of two parts, Part A-General and Part B-Requirements for ships and life-saving appliances, each of which contains subdivisions. Part A deals with: 1. Application; 2. Exemptions; 3. Definitions; 4. Evaluation testing and approval of life-saving appliances and arrangements; 5. Production tests. Part B contains five sections, each with its own subdivisions: Section I-Passenger ships and cargo ships deals with aspects referring to: Section II Passenger ships (additional requirements); Section III Cargo ships (additional requirements); Section IV Life-saving appliances and arrangements requirements; Section V-Miscellaneous.[2]

Specific technical requirements are contained in a new International Life-Saving Appliance (LSA) Code, which also

Convention. The 1974 Chapter III consisted of three parts: Part A contains general requirements, which apply to all ships, describes appliances by type, their equipment, construction specifications, methods of determining their capacity and provisions for maintenance and availability. It also describes procedures for emergency and routine drills. Parts B and C contain additional requirements for passenger and cargo ships respectively. [1]

passenger ships must be capable of being launched with their full complement of persons and equipment within 30 minutes from the time the abandon ship signal is given. This is sometimes erroneously taken to mean that ships must be designed to stay afloat for 30 minutes after an accident - something that is impossible to guarantee, since there is no way of saying what damage the ship might sustain. [1]

Based on another regulation, the chapter requires that survival craft be capable of being launched when the ship has a list of 20 degrees in either direction: the original Chapter III of SOLAS 1974 only requires launching to be possible with a 15 degree list. [1] The 1983 Chapter III requires cargo ships to carry sufficient totally enclosed lifeboats on each side to accommodate all on board. Chemical and oil tankers were required to carry totally enclosed lifeboats equipped with a self-contained air support system (if the cargo gives off toxic gases).When carrying flammable cargoes, lifeboats must afford protection against fire for at least eight minutes. The requirements and minimum specifications for inflatable and rigid liferafts were rewritten and expanded, including several regulations designed to ensure that all life-saving appliances are kept in good condition and can be used promptly in the event of an emergency. [1]

The 1983 Chapter III also included a new requirement that lifeboats on cargo ships of 20,000 gross tonnage and above be capable of being launched when the ship is making headway at speeds of up to 5 knots. This was in response to the fact that ships have increased greatly in size since the original chapter was drafted and could now take much longer to stop following an emergency. [1] The 1983 Amendments to Chapter III included a number of regulations designed to reduce the threat of hypothermia. These included requirements for improved personal life-saving appliances: including immersion suits (protective suits which reduce the body heat-loss of a person in cold water) and thermal protective aids (a bag or suit made of waterproof material with low thermal conductivity). Another focus of the revised Chapter III was on survival of persons faced with severe elements after abandoning ship, particularly the effects of hypothermia. The 1983 Chapter III also made it easier for survivors to be located. Lifejackets must be fitted with lights and a whistle and the use of retro-reflective materials is also provided. [1]

became mandatory on 1 July 1998. The Code is made mandatory under Regulation 34, which states that all life-saving appliances and arrangements shall comply with the applicable requirements of the LSA Code. The text of the new Chapter takes into consideration technological changes, such as the development of marine evacuation systems: these systems involve the use of slides, similar to those installed on aircraft. [1]

The amendments also reflect the public concern over safety issues, raised by a series of major accidents in the 1980s and 1990s. Many of the passenger ship regulations were made applicable to existing ships, and extra regulations were introduced specifically for ro-ro passenger ships. They must, for example, be equipped with fast rescue boats and must be equipped with means for recovering survivors from the water and rescue units. They must also be equipped with a helicopter pick-up area while 130m long passenger ships and over, built after 1 July 1999, must be fitted with a helicopter landing area. [1]

The new Chapter states that all passengers on passenger ships “shall be counted prior to departure” and that not later than 1 January 1999 “the names and gender of all

persons on board, distinguishing between adults, children and infants shall be recorded for search and rescue purposes”. The revised chapter also puts considerable emphasis on the abilities of officers and crews. There are requirements for training manuals and on-board training aids, instructions for on-board maintenance and passenger ships will be required to carry a decision support system on the bridge for the use of

The International Life-Saving Appliance (LSA) Code

The LSA Code was adopted in 1996 by means of Resolution MSC 48(66) as a result of the need to offer international standards for life-saving appliances required by chapter III of the International Convention for the Safety of Life at Sea (SOLAS), 1974. It became mandatory starting 1 July 1998 by Resolution MSC 47(66) which adopted inter alia, amendments to chapter III SOLAS. [3]

The LSA Code gives technical details and minimum specifications for life-saving appliances and consists of seven chapters: Chapter I General: definitions and general requirements for life-saving appliances; Chapter II Personal Life-saving appliances: lifebuoy; lifejackets; immersion suits;

The Role of the Maritime Safety Committee

In 2008, MSC adopted amendments to Regulations III /6, III/26 and IV/7 SOLAS to replace requirements for “radar transponders” with a requirement for a search and rescue locating device. “Amendments are expected to enter into force on 1 January 2010. Similarly, the 1988 SOLAS Protocol was also amended, to replace the reference to “radar transponders” with a reference to “search and rescue locating devices”, in the form of safety certificate for passenger ships and forms of safety certificate for cargo ships. [4]

In 2006, on its 82nd session, MSC adopted an amendment to SOLAS Regulation III/19.3.3.4 concerning provisions for the launch of free-fall lifeboats during abandonment drills. The amendment will allow, during the abandonment drill, for the lifeboat to either be free-fall launched with only the required operating crew on board, or lowered into the water by means of the secondary means of launching without the operating crew on board, and then manoeuvred in the water by the operating crew. The goal is to prevent accidents involving lifeboats occurring during abandonment drills. This amendment entered into force on 1 July 2008. [5]

Regulation 7 Personal life-saving appliances, Chapter III-Life-saving appliances and arrangements was also amended in 2006. These added a new requirement for infant lifejackets. For passenger ships on voyages of less than 24 hours, a number of infant lifejackets equal to at least 2.5% of the number of passengers on board is to be provided; and for passenger ships on voyages of 24 hours or greater, infant lifejackets are to be provided for each infant on board. A further amendment relates to the provision of lifejackets for larger passengers and states that, if the adult lifejackets provided are not designed to fit persons with a chest girth of up to 1,750 mm, a sufficient number of suitable accessories are to be available on board to allow them to be secured to such persons [6]. In 2004, MSC adopted Resolution MSC.152(78) -Adoption of amendments to the International Convention for the Safety of Life at Sea, 1974, as amended, amendments to SOLAS chapter III (Life-saving appliances and arrangements), meant to prevent accidents involving lifeboats during drills. The amendments, entering into force on 1 July 2006, originate in the activity carried out by the Sub-Committee on Ship Design and Equipment (DE) designed to address the unacceptably large number of accidents involving lifeboats during the last years. The crew was injured, sometimes fatally, while participating in lifeboat drills and/or inspections. [7]

Amendments to Regulation 19 (Emergency training and drills) and to regulation 20 (Operational readiness, maintenance

The Role of the Sub-Committee on Ship Design and Equipment (DE)

Sub-Committee DE drew up draft amendments to SOLAS chapter III and to the International Life-Saving Appliances (LSA) Code for submission to the Maritime Safety

masters. This describes what action should be taken in the event of various emergencies. [1]

The new Chapter is reinforced by the use of footnotes which refer to other measures adopted by IMO, including codes of practice, recommendations and performance standards. Important focus is also placed on communications - among crew members, and between crew and passengers. [1]

antiexposure suits; thermal protective aids Chapter III Visual signals: rocket parachute flares; hand flares; buoyant smoke signals Chapter IV Survival Craft: general requirements for liferafts; inflatable liferafts; rigid liferafts; general requirements for lifeboats; partially enclosed lifeboats; totally enclosed lifeboats; free-fall lifeboats; lifeboats with a self-contained air support system; fireprotected lifeboats; Chapter V Rescue boats; Chapter VI Launching and embarkation appliances: Launching and embarkation appliances; marine evacuation systems; Chapter VII Other life-saving appliances: line-throwing appliances; general alarm and public address system.[3]

and inspections) refer to the conditions in which lifeboat emergency training and drills should be conducted and introduce changes to the operational requirements during weekly and monthly inspections so as not to require the designated crew members to be on board in any case. MSC also approved a circular MSC/Circ.1115 Prevention of accidents in high free-fall launching of lifeboats with regard to free-fall lifeboats being launched from a great height, taking into consideration recent reports of injuries during free-fall launches of free-fall lifeboats from heights greater than 20 metres. [7] MSC also adopted amendments to SOLAS chapter III Regulation 32 - Personal life-saving appliances - to change the number of immersion suits to be carried on all cargo ships. The amendments introduce carriage requirements for one immersion suit per person on board all cargo ships, including bulk carriers. At present, the regulation requires carriage of at least three immersion suits for each lifeboat on a cargo ship, as well as thermal protective aids for persons not provided with immersion suits. Along with the adoption of the proposed amendments, entering into force on 1 July 2006, immersion suits will become, as lifejackets, a personal life-saving appliance for each person on board, thus offering better thermal protection and a higher chance of survival and rescue. [7]

The MSC also adopted by Resolution MSC.154(78) -Adoption of amendments to the Protocol of 1988 relating to the International Convention for the Safety of Life at Sea, 1974-subsequent amendments to the 1988 SOLAS Protocol relating to the records of equipment. [7]

Other previously adopted amendments to SOLAS chapter III relate to additional requirements for ro-ro passenger ships making it mandatory for liferafts carried on ro-ro passenger ships to be fitted with a radar transponder in the ratio of one transponder for every four liferafts - Resolution MSC.134(76) - Adoption of amendments to the International Convention for the Safety of Life at Sea, 1974, as amended in 2002 [8]; obligativity that all ro-ro passenger ships be fitted with a fast rescue boat, as well as a means of rescue - MSC/Circ.1016 Application of SOLAS regulation III/26 concerning fast rescue boats and means of rescue systems on ro-ro passenger ships in 2001.[9]; standardized evaluation and test report forms for all life-saving appliances, from lifeboats to lifejackets - MSC/Circ.980 Standardized life-saving appliance evaluation and test report forms[10]; setting a helicopter landing area on ro-ro passenger ships only by MSC/Circ.907 Application of SOLAS regulation III/28.2 concerning helicopter landing areas on non ro-ro passenger ships.[11]

Committee (MSC). The Sub-Committee established a working group to discuss issues under the working plan of the sub-committee to develop measures to prevent lifeboat accidents. The activity is meant to address the unacceptably large number of accidents involving lifeboats during the last years,

when the crew was injured, sometimes fatally, while participating in lifeboat drills and/or inspections. [12; 13; 14; 15; 16] In 2009, a proposed draft amendment to SOLAS chapter III, was submitted to MSC, requiring the replacement of certain existing release hooks not complying with the new requirements, The Draft Guidelines for the fitting and use of fall preventer devices (FPDs) were also agreed upon. An FPD can be used to minimize the risk of injury or death by providing a secondary alternate load path in case of failure of the on-load hook or its release mechanism, or of accidental release of the on-load hook, but should not be regarded as a substitute for a safe on-load release mechanism. [17]

Meanwhile, the Correspondence Group on Life-Saving Appliances was instructed to draw up guidelines for the qualification and certification of organizations or personnel for servicing and maintenance of lifeboats, launching appliances and on-load release gear.[17; 18] The Correspondence Group was also tasked with drawing up amendments to Life-Saving Appliances (LSA) Code and the Revised recommendation on testing of life saving appliances concerning the design criteria for free-fall lifeboat seats and seating space and lifeboat release gear.[17; 18] The LSA

Correspondence Group shall also take into account the proposed amendments to various IMO instruments relating to testing standards for extended service intervals of inflatable liferafts. [18]

The Sub-Committee instructed the LSA Correspondence Group to draw up amendments to the LSA Code and the Revised recommendation on testing of life saving appliances and to take into consideration the increasing size of seafarers globally; as well as to draw up guidelines on wearing immersion suits inside totally enclosed lifeboats. It was agreed that large-sized persons might cause operation problems of the rescue systems, especially with respect to immersion suits. Also, wearing immersion suits and lifejackets inside totally enclosed may cause problems due to overheating and dehydration, hence the need for guidelines/amendments. [12; 18]

Other circulars agreed upon under the DE Sub-committee and submitted for approval to MSC relate to aspects pertaining to: arrangements for remotely located survival craft [18], symbols related to life-saving- appliances and arrangements [18]; improved thermal protection.[19; 20]

Conclusion

The current review of SOLAS Chapter III and the LSA Code is the result of lessons learnt from shipping accidents in the last two decades and the result of incorporating technology progress. What guarantees the success of this process is on the one hand the good

cooperation between the Maritime Safety Committee and the Sub-Committee on Ship Design and Equipment (DE) and, on the other hand, the nature of the amendment procedure of the Convention, allowing a fast entry into force of amendments before they are technologically outdated.

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THE ECONOMIC VARIETY SUPPORT IN THE RURAL AREA

Mădălina ALBU¹

¹ PhD Lecturer, Petroleum – Gas University of Ploiești

Abstract: *Economic diversification is an increase in community employment through the introduction of a new industry or through the expansion of an existing industry other than a single sector or dominant industry. Rural community economic diversification, is one solution to the problems facing rural regions and small towns. This paper presents a case study on Cornu village.*

Key words: *economic activity, rural area*

Introduction

One of the fundamental problems in the rural economic field is represented by the reorganizational process impact in agriculture and the implied need for diversity and economic growth of rural economy in the non – agricultural district.

The development and diversity of economic activity from the rural areas and the growing grade of seizure through the enterprise development and the establishment of working places is the essential element for maintaining the rural population prosperity.

The diversity in the economic field non – agricultural from the agricultural farms and the encouragement of the entrepreneurs in the rural area can be made through:

- the establishment, the upgrading, the diversity of the facilities and the tourism sights
- the establishment and basic physical infrastructure update in the rural area
- the improvement of social environment status, natural and economic in the rural area
- the protection and preservation of the cultural and natural rural patrimony
- the development of the local actors skills, for the stimulation of the area organization

1 The development and updating of rural areas – case survey: Cornu, Prahova district

Situated in the north – west of Prahova district, on the middle valley of Prahova river, 500 – 600 m altitude, Cornu village has a 15,6² km and a number of aprox. 5000 inhabitants, being formed of two parts : Cornu de Jos și Cornu de Sus [1].

Inside this area a number of 120 economic agents develop their economic activities, 5 are IMMs with foreign capital in the following fields:

- productive activities: pharmaceuticals' industry technologies, fine mechanics parts, non - metal foundry, ready-made clothes, industrial and civil constructions;
- labour services: 4 fuel stations, car-washes, auto service;
- commerce and public alimentation: bakery and mixt stores.

The rural development programme is focused on 3 key challenges: the transformation and upgradation of production fields and the agricultural and forest management processing, the maintenance and consolidation of rural environment quality and the ensurance of economic and social conditions proper for the rural population.

The main directions regarding the actions in the following period aim:

2 The economic – social developing programme – as a planning and implementation programme - contains a set of politics on certain activities fields that are applied inside a dead-line in order to achieve general objectives in a strategy. The dead – line for action local plan must be until a period of 10 – 20 years, made to achieve the Permanent Development Local Strategy (PDLs). Periodical, the programme is audited, thus the targets for the programme take into account the macroeconomic evolution at a national level, the economy status at the regional level and local, as well as the local community's opinions regarding its implementation. If the revision is made at smaller intervals, the error margin for the resources evaluation at a project would be smaller, adding that, with the time passing, the economic variables must be calculate at an economic prognosis that multiplies.

General objectives:

Specific activities, others then the agricultural and logging in the rural area depend on the territorial /commercial distribution and other activities from the distribution chain. Thus, we can say that the main activities depend on the local natural resources that are available, on the relief and the area traditions. Still, the rural economy has a reduced diversity and is connected to the agricultural activities, thus the consequence is the low rate of the entrepreneurs incomes from the rural area.

Nowadays, the main ways for the IMMs development and the co-operative societies from the rural area could be:

- a) The support of the private entrepreneurs that want to extend their business through applications in the external finance programmes by special consulting and correct information over the conditions for the programmes access.
- b) The capitalization of entrepreneurs' potential especially in the industrial fields that evaluate the local raw stocks (food and milk processing industry, wood processing industry, textile industry) as well as the qualified labour that exists in the rural area
- c) The allurement of new investors for the existing touristic resources capitalization (curative rheumatic and neurological hot spa).

- a) the incitement of the absorbing capacity of SAPARD funds, the “Fermierul” Programme and other specific programmes, in order to line up with the E.U.'s requests, the up gradation of the existing material base from the rural environment and the capitalization of agro touring potential of the town;
- b) the continuity of the developing works regarding the pavement and the bitumen of the roads;
- c) the development of certain communication actions, media, the promotion among the agricultural producers:
 - symposiums, fairs, animals presentation, vegetables – fruits, wine and other agrarian products
 - meetings with the agricultural producers in order to popularize the normative act in this field, the popularization of the E.U. requests regarding the integration of Romania, the efficiency in the use of technologies for the vegetable and zoo technical branches

The developing programme for the 2008 – 2011 period contains a series of investigations and objectives egresses from the inhabitants' requisitions, on one hand, and from the necessity of the strategic development strategy until the present, on the other hand.

- the development of the basic infrastructure and the free access ensurance for the population and the industrial consumers at this infrastructure (water, electricity, gass distribution, transport ways)
- The access to the habitat
- The protection of environment
- The cut of indigence
- The urban revival (the natural fund, especially the lands and the infected water resources, historical buildings)
- The development of the basis infrastructure and the ensurance of the free access for the population and industrial consumers at this infrastructure (water, electricity, gass distribution, transport)
 - The access for a home
 - The environment protection
 - The cut of poverty

➤ The urban revival (the revival of natural capital, especially for the land and polluted water resources, the urban rehabilitation by the restoration and development of the center, the historic buildings placed outside the limited historic area and the redevelopment of the buildings through the transformation of the frontage and the basic functions or the redefinition of these functions)

3 The rural potential capitalization, natural and etno – cultural

The rural area represents in Prahova 93% from the total surface and 61, 1 % from the total population (01.01.2007), numbers that underline its importance for the balanced development of Prahova, the weighting of human and natural resources focused in this space being overwhelming. Also, the rural environment has a major percentage in the county economy, as well for the agricultural fields and the industries connected to this and for the economic activities from the rural environment [2].

The rural area is also important through its potential and bountiful tourism – by its natural environment that has a high ecological value, through the attractiveness of cropped nature, as well as the cultural- ethnographic and the patrimony objects located in this area.

As the subsoil resources, the industrial tradition and the urbanization grade/ work services are limited, the main developing potential is focused in or is connected to the rural environment.

Taking into account that the coercion of the exterior environment and the actual specific of our county, for the maximization of the benefits of the financial investments, human and informational in a limited period of time, the present strategy is based on the following developing option:

4 The creation and promotion of a local turistic identity

Orientative operations [3]:

- The making of an organizational structure of combining the local actors' interest in the tourism field in a unique setting to represent the tourism of the county by creating a County Tourism Association (ONG without a patrimony purpose)
- Establishing an Information Turistic center
- The elaboration and dissemination of promotion flyers for the touristic offer, including the turistic maps;
- The creation of a multilingual site for the presentation of the touristic offer, connected to the sites of the county, local and national institutions
- The creation of an electronic and interactive map and of a catalogue with turistic products and services on an electronic support.
- The development and restructuring of the tourist accommodation by accessing the finances for the touristic

5 The agrarian exploits upgradation and competitiveness growth in IMMs from the agro – food industry

Action directions [3]:

- The exploits adjustment to the new European standards
- The profile adjustment, the level and the quality of the farm's production according to the market requirements
- The development of the services for the agriculture
- Investments in the exploits that use the ecological agriculture
- Support to obtain certificates for the eco – agricultural
- The adaptation to the veterinary standards, of hygiene and the well – being of the animals, phytosanitary, ecological and others.
- The enhancement of production opportunities and agrarian products that follow the european standards through the acquisition of equipments for agrarian product deposits

6 The support of economic diversity in the rural space and the revival of traditional draftsmanships

Orientative operations:

- Investments in non – agricultural activities as:
 - In activities of industrial processing for the wooden products – starting from lumber, as furniture
- Investments for the development of activities as craftsmanship and other traditional activities non – agrarian

The implication of all partners, no matter if they represent the civil community or the local public administration or groups of interests, is the best way for a rapid implementation of the programmed and the achievement of the strategic aim for a long development in all our society structures.

The keep of the present evolutive line and the maxim capitalization of the rural potential, natural and etno – cultural of the town, through the innovative approach of tourism, the food industry and rural economic diversity.

Thus, the revival and the commercial exploitation of traditional draftsmanship follow the same integration mutual logic benefited to the tourism development as well as the agrarian/alimentary. Moreover, the traditional draftsmanship can represent – if they are integrated in the commercial cycle – excellent ways for the diversity of rural economies dependent on agriculture, adding to the growth of incomes for the rural population and their stability, and the modality with added high value for the agrarian and local forestry products.

Specific goals:

- The development of the rural tourism, eco – tourism, cultural – historic – ethnographic and spa
- The development of agriculture and the growth of competitiveness of the IMMs from the agrarian – food industry that capitalize the local agricultural products, focused on the traditional and/or ecological, by supporting the access to new markets, especially European
- The rural economic diversity, the increase of the life quality and the revival of traditional craftsmanship by supporting the IMMs, the PFAs and the producers companies

pensions and agro – touristic and the trust for the existing pensions

- The rehabilitation and upgradation and the high standard of the existing facilities
- The public alimentation units development in the touristic areas – with an accent on the places that offer local/traditional products
- The professional preparation in the tourism field / hospitality industry, the standard upgradation for the existing personnel, the upgradation for the linguistic components.
- The training for the touristic guides and for their linguistic skills
- The development of the touristic attractions and the necessary infrastructure for these (golf fields, sport fields, other facilities for spending the free time, etc.)

- Investments for the growth of the forest economic value
- Investments in order to obtain eco – fuel from the forest bio – aggregation
- The maintenance of the bio – diversity and the landscapes especially ones with a High Natural Value that are threatened by the field utility, the intensification of agriculture and/or desertion
- The upgradation of farm's water and soil resources by the farmers, including the areas affected by the severe erosion processes and exposed to the loss of nutrients
- The information dissemination regarding the payment opportunities of agro – environment and the requirements that must be accomplished.

with a local specific (the artistic wood processing, wool, traditional sawings, pottery, metal objects, the traditional music instruments), as well as their marketing, a support for the small new outlets establishment, fairs attendances and events, support for the e – marketing of traditional craftsmanship products.

- Services for the rural population:
 - Tailoring, barber's shop, cobbler

- Internet connection
- etc.

- The creation of new micro – enterprises in the non – agricultural field

7 Conclusions:

The rural population life style is connected by a rich material and non – material patrimony, that offers a specific identity to the village – elements that must be kept and improved at the same time. The assistance given in this way must be supplemented with efforts in the natural and social environment, services, but also for the actions made for a better traditional and specific products' marketing.

A special attention must be given to encourage the investments made by the intercommunity development associations, their role becoming more and more important in the rural communities' development.

The development of the villages and especially the infrastructure, the bettering of air and water quality is not only a necessary requirement for the improvement of life quality and the growth of rural areas attractiveness but, also a very important element for the development of economic activities.

The villages and the rural areas must reach the level of competing efficiently to attract investments along with the ensurance of some adequate investments for the community and for other services for the local population.

The major objectives for the new rural development policy must focus on the improvement of agrarian competitiveness field.

The principles followed for the application of a rural development policy durable in Romania, according to the European requirements, aim the agriculture multifunctional, a multisection approach and integrated of the rural economy, the financial flexibility in supporting the rural development, very transparent in elaborating and implementing, capitalizing the funds for the rural development programmes.

The permanent rural development concept is connected with the quality and safety exigency and for the products that came from the rural areas also, involving the creation and production structures consolidation, agrarian and auxiliary, that should correspond the European tendencies of multifunctionality.

As a general conclusion, one can confirm that the rural development policy cannot only be seen as absolute, but it complements and accompany the marketing, by promoting the multifunctional agricultural character. In this context, the rural developing policy must be seen as a component for the regional integrating policy, making sure that the necessary extent for the territorial harmonization and it results from the social economic cohesion.

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ASPECTS OF LAW OF THE SEA CONVENTION - MONTEGO BAY 1982 -

Constantin ANECHITOAE¹

¹ Ph.D, Col. (r), Constanta „Ovidius” University

Abstract: On the 31st of March 2009, the number of parties to UNCLOS stood at 157, including the European Community. On the 31st of May 2007, Lesotho and Morocco ratified the Convention and expressed their consent to be bound by the Agreement relating to the Implementation of Part XI of the Convention (Part XI Agreement). Thus, on the 27th of July 2007, there were 129 parties to that Agreement, including the European Community. Following the accessions of Lithuania on the 1st of March 2007, of the Czech Republic on the 19th of March 2007, and of Romania on the 16th of July 2007, the number of parties to the 1995 Fish Stocks Agreement rose to 67, including the European Community [1].

Keywords: *UNCLOS; Law of the Sea Convention; Romania; Black Sea; Danube; geopolitics; axes*

1. The legal frame

All the countries in the world are continuously striving to decide on the proper legal norms for the international cooperation process, in order to piece up the differences in an amicable way, through negotiations based on legal equality, according to the art. 2, paragraph 3 of the United Nations Charter.

During different stages and phases of its development, the social and economic life depends upon

the maritime field, where, through the common efforts of the entire humanity, we are called upon to obey fundamental requirements regarding: a) the rights and duties of each state for the use of seas and oceans of the world; b) the definition of practical forms and means in order to improve their riches.

2. The international legal frame

The most important international forum - the United Nations Organization - has had preoccupations regarding the coding of legal regulations and norms in the maritime field.

In 1958, during the first UNO Conference on the Law of the Sea, concrete norms were drawn up for the first time in all fields of maritime law, i.e. the territorial sea, the continental shelf, the free sea and fishing; thus, all maritime spaces have been included in a general concept envisaging both the issue of the national area, with the rights and the obligations of the neighboring states and of the other states in the region, and the issue of the free sea, where the rights to sail, to fish, to lay cables and pipelines and to fly over were recognized. Besides the adoption of these regulations, other important issues, such as those concerning the limit of the territorial sea and the regime of the submarine land, have been reconsidered, in order to draw up new legal solutions. Thus, following the debates during 1967 – 1970 regarding the legal regime of the submarine land which is beyond the limits of the national jurisdiction, the General Assembly of the UNO adopted, in 1970, the *Declaration of Principles*, through which

the international area was established as “a common patrimony of mankind”.

Gradually, the issue of this patrimony has stirred more and more interest; ways and practical means to draw up and to exploit the resources in these territories have been approached and the conclusion was that mineral resources should be capitalized on equal terms and under no circumstances should the resources “be acquired by certain states or individuals”.

Under the influence of the sweeping changes in the world economy, as a consequence of the contemporary scientific and technical revolution, when new resources have been discovered, and due to the exacerbation brought about by the noxious effects of pollution on the marine benthos, further developments of maritime reports have determined the summon of the 3rd UNO Conference on the Law of the Sea in 1970.

The Conference adopted in a constructive manner all maritime issues in order to obtain “real progress in setting an exploration and exploitation system of the resources of the oceans in *the interest of all nations*”.

3. The national legal frame

The Convention on the Law of the Sea of the 12th of December 1982, signed in Montego Bay - Jamaica, provides even in the Preamble the wish of States parties to settle, in a spirit of understanding and mutual cooperation, all the issues regarding the law of the sea, so that they ensure a legal order for seas and oceans, in order to facilitate the international communications and the peaceful use of seas and oceans, the unprejudiced and efficient use of biological and mineral resources of the marine environment, as well as its protection and preservation [2].

At the same time, it is stated that the seabed area, as well as its subsoil beyond the limits of the national jurisdiction, and the resources of this area are and must be considered as a common patrimony of mankind, and its exploration and exploitation are to be performed in the common interest of mankind, regardless of the geographical position of states. The Convention ascertains the entire sovereignty of the neighboring country over the territorial sea, over the air space above the territorial sea and over the seabed and its subsoil [3].

Romania was one of the 160 attendant states at the 3rd UNO Conference on the Law of the Sea, at the negotiation process, which aimed at identifying the solutions which can be generally

4. The legal regulations regarding the marine scientific research

By the ratifying Act of the Convention on the Law of the Sea of 1982, Romania has given its consent to become part to it, and the provisions of the Convention are part of its national legal regulations.

In part XI, Section 2, art. 143, and in part XIII art. 238-277, in the Convention on the Law of the Sea, there are provided express provisions regarding the marine scientific research.

According to the provisions of the art. 238 in Convention on the Law of the Sea of 1982, all states, irrespective of their geographical situation, as well as competent international bodies, are entitled to perform marine scientific research under the reserve of other states rights and duties, as defined in the Convention.

According to art. 239, international competent States and organizations will encourage and facilitate the development and conduct of marine scientific research, according to the provisions of the Convention [5].

Marine scientific research will observe the following principles:

- a) It will be conducted for peaceful purposes exclusively;
- b) It will use proper scientific methods compatible with the Convention;
- c) It will not interfere unjustly with other legitimate uses of the sea which are compatible with the Convention and which will be taken into consideration during the use, as agreed; d) It will be conducted according to all pertinent regulations adopted when applying the Convention, including those

5. 27 years since the adoption of the convention on the law of the sea

This year we celebrate 27 years since the adoption of the Convention on the Law of the Sea; it was signed in Montego Bay – Jamaica, on the 10th of December 1982.

When the Convention on the Law of the Sea was adopted, everybody expected that an order will be established concerning the issues related to the sea and, at the same time, concerning a uniform exploitation of the riches of the Planetary Ocean, in the benefit of all nations.

The reference period was scattered with many misunderstandings and disputes regarding the settlement of issues according to the provisions of this Convention.

During this period, all the institutions mentioned in the Convention have been designed to deal with the solving of this problem and they have made efforts in this respect.

The issue of limiting some maritime areas between riverside states to the seas and oceans of the world has not been finished yet and, as a consequence, we appreciate that these may cause a potential conflict.

We can also mention a new area which may bring about a potential conflict. This is determined by the climatic changes which call forth the thawing of the ice cap, and, thus, disclose

applied in order to equally make use of the sea and ocean riches on Earth.

According to its wish to range with the international provisions, Romania ratified and adhered to the Convention on the Law of the Sea, by the Law 110 of the 10th of October 1996, and, at the same time, it adhered to the Agreement regarding the application of Part XI of the UNO Convention on the law of the Sea, concluded in New York on the 28th of July 1994.

By Law 98 of 16/04/2007, Romania implemented the Agreement for the application of the provisions of the Convention on the Law of the Sea of 10th of December 1982 concerning the preservation and management of anadromous fish stocks and stocks of large migrating fish, concluded in New York, on the 4th of August 1995.

Through a Declaration reaffirmed during the ratification of the Montego Bay Convention, Romania, as a disadvantaged country from a geographical point of view, because it neighbors a sea poor in fishing resources, has stated the necessity to develop the international cooperation in the field of capitalizing fishing resources in economic areas based on equal and fair agreements that would ensure the access of countries in this area of fishing resources, in the economic areas of other regions and sub-regions [4].

regarding the protection and the preservation of the marine environment.

Part XI, “The Area”, in Section 2, article 143, in the Convention on the Law of the Sea, includes express provisions regarding the marine scientific research.

Thus, according to provisions, “Marine scientific research in the area will be conducted with exclusive peaceful purposes and in the interest of mankind, according to part XIII in the Convention on the Law of the Sea”.

State parties are entitled to conduct scientific research in the area. They will encourage the international cooperation in the field of marine scientific research in the area:

- a) By taking part to international programs and by encouraging the cooperation in the field of marine scientific research conducted by the personnel in different countries and of the authority;
- b) By making sure that programs are drawn up by authorities or by other international organizations, as the case may be, for the advantage of developing states and of less advanced states from a technological point of view, so that: 1) Their scientific potential is increased; 2) The personnel and the authority in the field of scientific techniques and applications are formed; 3) The qualified personnel is trained for the scientific activities conducted in the area; 4) When available, the outcome of research and analysis is disseminated by means of the authority or other international mechanisms, as the case may be.

new possibilities to explore and exploit resources with restricted access in respect with the economic potential of certain states.

This is also a present reality since the objectives of the convention in what concerns the exploration and exploitation of seas and oceans of the world unconventionally dissociate between the economic advanced countries, in respect with the expectancies of the under-developed countries which have not practically capitalized on the advantages of these international provisions. Illegal fishing and other maritime offences are activities which violate the provisions of the Convention on the Law of the Sea and which are still going on in certain maritime areas without the real possibility to prevent or sanction them by applying corrective forces of the maritime world.

Some clarifications regarding military and security activities are expected that would clearly state rules concerning foreign military operations and intelligence activities in the Economic Exclusive Zone.

Also, measures envisaged for maintaining security at sea are still not clearly defined, thus enabling threats of international terrorism on land, extending to the sea as well.

Many states have no logistics to perform control so as to impose measures and to maintain a state of safety regarding the navigation of tankers in adjacent areas of the Contiguous Zone and Territorial Sea, respectively.

In areas restricted to certain rules under the control of riverside states through their political and economic pressures, a threat regarding the freedom of safe navigation can be foreseen in the interest of the countries which owe tankers with drafts over the maximum admitted limits. The problem of “the innocent passing” and the situation of mines on the seabed, which have not been detected and destroyed yet, must be also considered in what regards maritime safety, and the international authorities should revise their approach in this respect.

If until the adoption of the Convention on the Law of the Sea the academic teams of experts have played an important part in promoting negotiation regarding maritime issues among states, after 25 years there is a decrease of

6. The 61st anniversary of the adoption of the IMO convention

The year 2009 contains a number of key milestones and anniversaries for IMO.

March saw the 61st anniversary of the adoption of the IMO Convention at a conference held in Geneva, in 1948, under the auspices of the United Nations.

6.1 1948 - 2009

There is no doubt that IMO has come a very long way since its conception.

The Organization was born into a world weary from war and in which the old colonial powers still held sway in terms of global prosperity and trade. As a consequence, these were also major powers in shipping and, as the leading maritime nations, they tended to create their own standards with regard to vessel construction, safety, manning and so on.

But, in 1948, the new spirit of the global unity that was in the air and the first glimpses at the horizon of a new world order combined in order to cause a number of far-sighted nations to draw up the blueprint for an international organization that would develop standards for shipping – for the adoption and universal implementation throughout the entire industry. It was becoming generally accepted that a

7. The international conference on the safe and environmentally sound recycling of ships, Hong Kong, China, 11-15 May 2009

A Diplomatic Conference held in order to adopt an international convention on the recycling of ships was opened in Hong Kong, China, by the Secretary-General of the International Maritime Organization (IMO), Mr. Efthimios E. Mitropoulos, on Monday (11 May 2009) [6]. The convention, the first ever to address ship recycling issues, is aimed at ensuring that ships, when being recycled after reaching the end of their operational lives, do not pose any unnecessary risk to human health and safety or to the environment.

Mr. Efthimios E. Mitropoulos says: “For the countries which are active in the disposal of end-of-life ships, and for others aspiring to invest in this industry, ship recycling provides opportunities for employment and an economic and trading venture for tens of thousands of people, particularly in communities that are not among the wealthiest in the world. It

their role. This role has been taken over by the 155 states which have adhered or ratified this Convention so far.

The process to include the provisions of the Convention on the Law of the Sea in the national maritime law is closely linked to the act of its ratification. In this respect, we consider that most provisions of this Convention contain legal norms which, in a certain degree, support the initiatives of underdeveloped countries, but they still remain ineffective because of their reduced economic potential. The legal norms edited by the Convention have imposed to all states to accept the obligations on equal terms in order to perform maritime activities but they disregard the economic and political realities of the industrialized countries. In this respect, we can singularize the United States of America, a country which has not ratified the Convention on the Law of the Sea up to the present, although in the issues of international law and external policy they observe and promote its principles.

The 17th of March marked the 51st anniversary of that Convention entering into force in 1958.

June saw the 100th meeting of the IMO Council, the executive organ of IMO, which is responsible, under the Assembly, for supervising the work of the Organization in between successive sessions of the latter.

situation in which each shipping nation had its own maritime laws was a counter-productive one in ensuring safety in shipping operations worldwide. Not only that standards were different, but some were far higher than others. Conscientious safety-minded shipowners were at an economic disadvantage vis-à-vis their competitors who spent relatively little money on safety, and this was a threat to any serious attempt to improve safety at sea and the international seaborne trade as a whole.

Now, of course, all this has changed.

Globalization has transformed the international trade, new powers have emerged in shipping and the plethora of measures established by IMO has provided the bedrock on which a safer and cleaner industry can continue to develop and flourish.

also constitutes an activity that, by its very nature, is also regarded as environmentally beneficial - not to mention the wider re-use of most of a ship's fabric, materials, machinery, equipment and fittings. The fact that everything that constitutes a ship today may pass on, tomorrow, for the use in construction and ancillary industries; in the manufacturing and agricultural sectors; in small factories; in hospitals and other emergency centres; in hotels and households, displays another dimension of the activity that will occupy our minds this week. This makes it imperative that we intensify our efforts to ensure the success of the Conference, thus also ensuring that the convention that we have come here to adopt, on the one hand, heightens the safety and the environmental levels of ships and the recycling facilities and, on the other hand, does not interfere inadvertently with the vital process of constant renewal, thus creating an all-inclusive regulatory regime of the kind that has been among the hallmarks of the IMO”.

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MARITIME ENGLISH-TEACHING/LEARNING RESOURCES-COURSE BOOK PRESENTATION

Carmen ASTRATINEI¹

¹ Lector univ. dr., Academia Navală “Mircea cel Bătrân”

Abstract: *The aim of this paper is to discuss ESP English, with special reference to the place of ESP Maritime English within the wide range of English teaching/learning resources. A brief introduction will be made reviewing the literature on the subject matter, then an attempt of Maritime English resources and materials classification will be presented. Finally, the first unit of a navigation 1st year course book will be presented highlighting its self-study component.*

Key words: *maritime English; teaching/learning resources; self-study*

1. A brief overview of ESP

The development of scientific, technical and economic activity on an international scale after the World War II called for an international language. For various reasons, due to the economic power of the United States in the post war world, this role fell to English. A foreign language used to be learned in terms of a well-rounded education but with the advent of economic and scientific boom learners have become aware of what they need a foreign language, especially English for. Hence, the foreign languages courses tailored to specific needs designed and conducted by ESP teachers.

But who is the ESP teacher? Since ESP is goal oriented, the ESP teachers have a great variety of often simultaneous roles: as course designers (as a result of a thorough needs analysis of the learners' needs), materials developers, testers, evaluators, as well as classroom teachers. In fact almost always they are teachers of General English who have unexpectedly found themselves required to teach students with special needs. “The experience is often a shock! The shock may be unwelcome because the teachers' training in English is more likely to be in literature than in language. For non-native speaking teachers of English, then, added to any doubts they may have about their competence in the language, there is likely to be fear that they may not cope with their students' areas of specialism”.(Stevens,1988).

2. ME resources and materials

While in the field of English for General Purposes (EGP) there has been a wealth of published materials commercially available on the market, this has not been the case for Maritime English, an important branch of ESP. Boris Pritchard finds some reasons for the scarcity of resources in the maritime field: non-existence of standards on Maritime textbooks; unarticulated demand and, in turn, lack of interest on the publishers' side; poor supply of textbooks for international use; restrictive national legislations and language policies; slow adjustment of conventional textbooks to the developments in foreign language teaching and modern teaching technologies [Prichard 2003].

Prichard attempts a classification of ME resources and materials. He uses a number of criteria: printed materials, electronic and internet resources

a)- textbooks/course books vs. supporting/supplementary materials

- written vs. aural or combined (multimedia)
- spoken maritime English vs. non-spoken
- paper vs. electronic/CD & software/internet-based
- maritime topic-oriented vs. language/function-oriented

b)- registered-based (nautical, marine engineering, maritime communications, maritime law) vs. genre-based (e.g. for vocational training of ratings, familiarization courses for passenger ship crews, etc.)

3. Navigation 1st year course book presentation

What do you have to consider when designing an ESP course book? First of all the specialist area the students are studying in the respective year and the requirements of the International IMO Conventions regarding the competences of the seafarer in using maritime English both on board ship with multilingual crews and with port authorities. Therefore, by the end of the four years of study our graduates should be able to demonstrate their

An important role in dispelling the fears and the mystique of specialist knowledge which shakes the ESP teachers' confidence, is played by the ESP teacher training programmes. In this respect, Ewer (1983) claims that an important function of a teacher trainer will be, in the first place, to try to overcome the trainees' dislike (or even fear) of science (meaning anything outside the humanities) by involving them in scientific activities, by having them observe and meet practicing scientists, or by getting them to conduct a small-scale experiment or other practical activity. A by-product of this practical work may be new insights for the trainees about the subject matter they are supposed to teach. In point of methodology, Baumgardner *et al.*(1988) suggests that the writing of materials is a very important aspect of teacher training because “it ensures that teachers will become more involved in the work of the course and will as a result teach the course materials with more understanding and confidence”

To conclude this brief introduction on the “strange world of ESP” we must agree with Pauline Robinson that being an ESP teacher is not easy and that the prime requisites would seem to be flexibility and a willingness to try new approaches and methods. We also agree with Stevens (1988) who suggests that “becoming an effective teacher of ESP requires *more* experience, *additional* training, *extra* effort, a *fresh* commitment, compared with being a teacher of General English.”

- comprehensive (General Maritime English) vs. tailored to suit specific purposes.

In addition, the resources for Maritime English teaching also include:

b)-studies, articles or papers and proceedings published as a result of various projects, conferences and workshops on or relating to Maritime English (e.g. MARCOM, METHAR, METNET, IMEC, WOME, IMLA, GAME, IAMU, AMETIAP, etc).

c) Electronic materials, on CD-ROM, and multimedia, and CALL software, are of particular interest both for the modern maritime English teacher and learner, because they allow a high degree of interactivity and self-learning. Here is a list of the materials retrievable from the internet:

- websites of maritime universities, colleges, academies, maritime training courses)
- commercial software developers (*Videotel, Seagull, Marlins, Marine Soft, etc.*)
- websites of shipping companies, crewing companies, etc.
- numerous individual websites run by former masters and other seafarers, maritime lexicographers, boat designers and builders, etc.
- publications available on the internet (e.g. N. Bowditch's *American Practical Navigation SAR Manuals, etc.*)

competence in using the SMCP (Standard Maritime Communication Phrases) both orally and in writing.

Having in mind the two criteria, I started working out the course book. As the modern teaching methodology is student-centered, I had to have in mind the self-study aspect. As a result, the units, being in accordance with the specialist knowledge, are divided into a specialty text followed by a vocabulary practice with answer-key, a grammar section, theory and practice, followed by a self-test with answer-key containing both vocabulary and grammar. In this way,

terminology is recycled through various exercises i.e. true/false; sentence completion; filling blanks; translations etc.

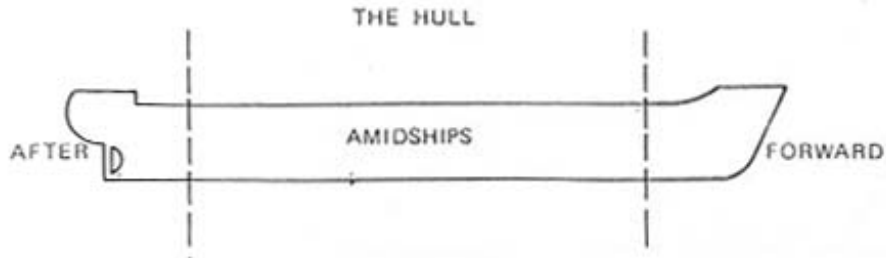
I will illustrate my intentions by presenting the first unit of the 1st year navigation course book:

SHIP STRUCTURE

1. General Structure of the Ship

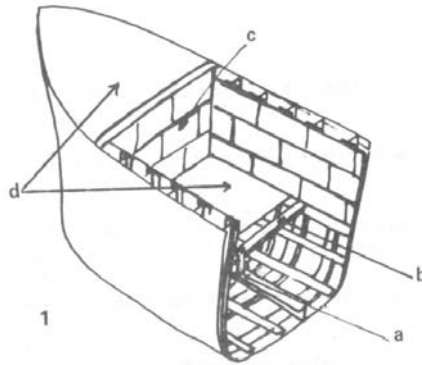
The main body of the ship is called **the hull**. The hull consists of an inside **framework** and an outside skin called **shell plating**. At the base of the hull is a heavy metal plate called **the keel**. When the ship is at sea this part of the

ship is under water. To make it easier to refer to parts of the ship, the hull is divided into three areas or parts. They are **the forward, amidships and after parts**. The forward part is nearest the **bow**. The after part is nearest the **stern**. Amidships is in the centre part of the ship. Identify the main parts of the hull in the diagram below:



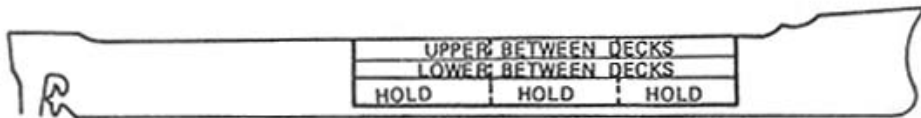
In the bow, the hull is attached to the **stem post**. In the stern, the hull is attached to the **sternpost**. The hull is divided into a number of **watertight compartments**. **Decks** divide the hull horizontally and **bulkheads** divide it vertically.

Deck beams support the decks and **stanchions** support the bulkheads. Label the deck beams and the stanchions on the diagram below:



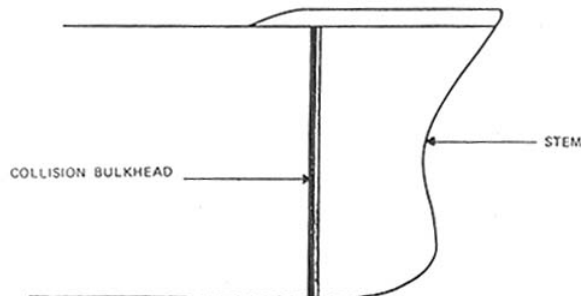
Cargoes are stored in cargo **holds**. Cargo holds are usually situated at the bottom of the ship. Within the hull, decks are given a special name, i.e. **between decks** (often

called simply **tween decks**). There may be **upper tween decks and lower tween decks** above the holds.



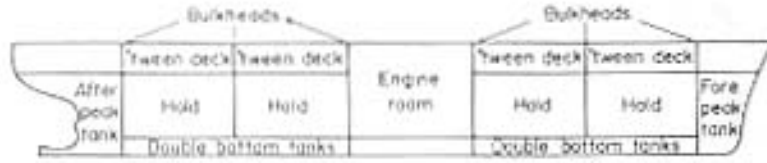
Bulkheads are partitions that can run either transversely (across the ship) or longitudinally (fore and aft). Sometimes bulkheads are built so that they are completely watertight. This makes it possible either to carry liquid

cargoes, or to seal off the ship if water should break in. The bulkhead nearest the stem must be very strong. If the ship is damaged it must remain watertight. This bulkhead is called **the collision bulkhead**.



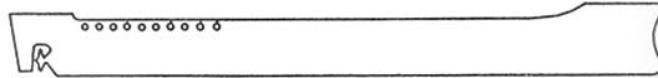
Besides the space for cargo the hull also contains **the engine room**, which is situated at the after end of the ship, and a number of tanks: at the fore end of the ship is the **forepeak tank**, and at the after end of the ship is the **after**

peak tank. These tanks are used for storing fresh water and ballast water. At the bottom of the ship is the **double bottom tank**, which is used for storing fuel and water ballast.

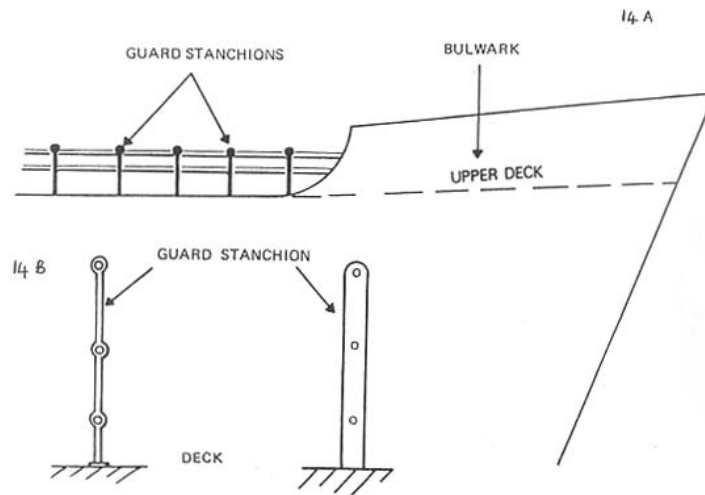


If you look at the after part of the ship's hull, you can see small round openings in the ship's side. These let

light and air into the cabins, the crew's quarters. The openings are called **portholes**.

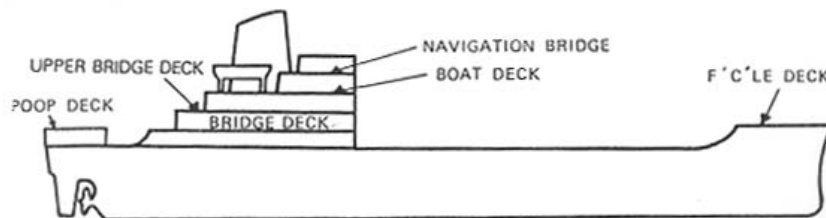


Now look at the diagram below:



The diagram shows you the **upper deck**, which is the deck covering the top of the hull, and the **bulwarks** at the fore and after end of the hull. The bulwark is an extension of the hull plating, which rises above the top of the upper deck. They act as a barrier against the force of the waves. Along the edge of the remainder of the upper deck, especially amidships, you will find a line of guard rails. These are made up of vertical posts called **guard stanchions** which are linked together by either wires or tubes. These protect the passengers and crew from falling overboard.

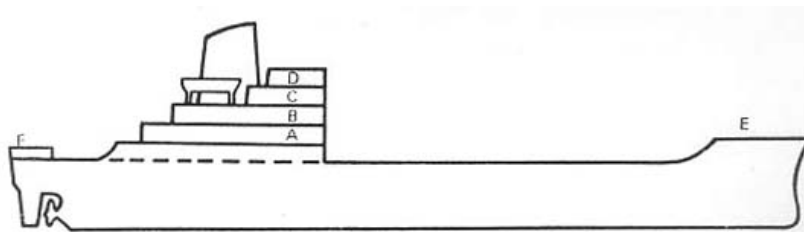
1.2 As stated previously, ships are divided off into different levels called decks. The upper deck is the deck which is level with the top of the hull. Modern ships also have decks forward and aft above the upper deck and these are called the **forecastle deck** and **poop deck**. Amidships above the level of the upper deck is the **superstructure**. On a cargo ship the superstructure is usually quite small. The superstructure consists of several decks each with a different purpose. In the diagram below the four decks are named.



The lowest of the four decks of the superstructure is called **the bridge deck**. The crew's quarters and the galley are on this deck. The next deck is **the upper bridge deck** or **saloon deck**. Here are cabins for the passengers and a lounge and saloon for their use. Above the saloon deck is the **boat deck**. On this deck the officers have their accommodation and so does the captain. On the boat deck you can also find **lifeboats**, which are raised and lowered into

the water by davits. The highest deck in the superstructure is called the **navigation bridge**. This is the nerve centre of the ship. The wheelhouse is here and so is the chart room and the radio room. The navigation bridge is where the ship is steered or conned from.

Look at the diagram below and name the four decks of the superstructure labelled as A to D. What are the decks E and F called?



On which deck are the following found?

- (a) Lifeboats
- (b) Wheelhouse
- (c) Galley
- (d) Passenger's accommodation
- (e) Crew's quarters
- (f) Captain's cabin.

3. VOCABULARY

Words and phrases

Hull = cocă, corp de navă; osatură, carcasă
 Keel= chilă
 Bow= prova
 Stern = pupa
 Forward = partea din față a navei, înainte, în prova
 Amidships = la cantrul/mijlocul navei; în axul navei; la cuplul maestru
 After = din(spre) pupa; la/spre pupa; înapoi
 Hold = magazie/hambar (de navă)
 Deck = punte de navă, covertă
 Bulkhead =perete etanș de navă, perete de compartimentare (de regulă transversal)
 Between deck ('tween deck) = întrepunte (spațiu)
 Watertight compartment = compartiment etanș
 Collision bulkhead = perete de coliziune/de forpic; perete de pic prova
 Stern post= ertava
 Sternpost =etambou
 Porthole =iublou

Bulwark = parapet, falsbord; spargeval de punte
 Guard stanchion = baston de balustradă
 Upper deck = punte superioară
 Forecastle deck = puntea teugă
 Poop deck = puntea dunată
 Superstructure = suprastructura
 Fore = prova; extremitate prova; // spre prova; în/la prova, dinspre prova
 Aft = pupa// la/spre/dinspre pupa, din pupa
 Bridge deck = punte de comandă/navigație
 Boat deck = punte a bărcilor; punte de promenadă (la navele de pasageri)
 Upper bridge deck = punte superioară
 Crew quarters = cabinele echipajului
 Galley = bucătărie (pe nava)
 Saloon deck = punte de clasa întâi (la navele de pasageri)
 Lounge = careu
 Accommodation = cabine, spațiu de locuit pentru ofițeri
 Lifeboats = bărci de salvare
 Wheelhouse = cameră a timonei
 Funnel = coș

4. Vocabulary Practice

I. Answer the following questions.

- a. What is the large part of a ship below the main deck consisting of an inside framework?
- b. What is the main structural part that goes along the bottom of a ship?
- c. How is the hull divided?
- d. Where is the cargo stowed?
- e. What are the spaces contained between decks within the hull called?
- f. What are the vertical partitions called?
- g. How do you call the windows of the ship?
- h. How do you call the deck which is level with the top of the hull?
- i. What is there amidships above the level of the upper deck?

II. Complete the following statements with one or two words.

- a. In the bow, the hull is attached to the
- b. In the stern, the hull is attached to the....

IV. Are these statements TRUE (T) or FALSE (F)? Circle the right answer.

- a. The upperdeck houses the crew's quarters. T/F
- b. The galley is where the food is prepared. T/F
- c. The upper bridge deck contains passengers' cabins. T/F

- c. The role of theis to seal off the ship if water should break in.
- d. At the fore end of the ship is the... ..
- e. At the after end of the ship is the
- f. At the bottom of the ship is the tank.
- g. The... is an extension of the hull plating , which rises above the top of the upper deck.
- h., which protect the passengers and crew from falling overboard, are linked together by either wires or tubes.

III. Fill in the blanks. Use the words below.

Poop, forecastle, decks, holds, upper, above, superstructure, cargo, fore, aft

On the cargo ship, the main body of the ship, the hull, is divided into...which contain....

The deck at the top of the hull is called the...deck. Above the upper deck are the...deck and the ... decks. The poop deck is...and the forecastle is ... Amidships...the level of the upper deck is the On a cargo ship the superstructure is usually quite small. The superstructure consists of several ... each with a different purpose.

- d. The crew's quarters are in the holds. T/F
- e. The upper bridge deck is sometimes called the saloon deck. T/F
- f. The galley is in the upper bridge deck. T/F

6. SELF-TEST

I. Fill in the blanks with the appropriate term(s)

1. The main body of the ship is called....
2. The hull consists of an inside.....
3. The forward part is nearest the.....
4. The after part is nearest the.....
5. In the bow, the hull is attached to the....
6. In the stern, the hull is attached to the...
7. The hull is divided into a number of....
- 8 divide the hull horizontally.
- 9 divide the hull vertically.
- 10 ... support the bulkheads. 10p

II. Answer the following questions:

1. Where are cargoes stored?
2. What are the special names given to the decks within the hull?
3. What is the purpose of the collision bulkhead?
4. What is the name of the tank at the fore end of the ship?
5. What is the name of the tank at the after end of the ship?

IV. Each pair of words contains one countable noun and one uncountable noun. Draw up two columns and put the nouns into the appropriate column.

1. accommodation/flat; 2. Desk/furniture; 3. Bag/luggage; 4. Work/job; 5. Travel/trip; 6.

V. Most of these sentences have a mistake in them. Correct them, or if there is no mistake, write RIGHT.

1. I believe it's very difficult to find a cheap accommodation in London.
..... to find cheap accommodation
2. We're looking for a place to rent **RIGHT**
3. We're late because they're re-surfacing the motorway and the traffics are terrible.
4. He was asked to leave the college because of a bad behaviour at the end of term party.
5. I'm going to phone my brother to wish him good luck for his driving test.

7. Self-Test-Answer Key

- I. 1. the hull; 2. framework; 3. the bow; 4. the stern; 5. stempost; 6. sternpost; 7. watertight compartments; 8. decks; 9. bulkheads; 10. stanchions
- II. 1. in the holds; 2. between decks or tween decks 3. to seal off the ship if water should break in; 4. forepeak tank; 5. afterpeak tank; 6. to store fuel and water; 7. ballast; 8. upper deck; 9. an extension of the hull plating, which rises above the top of the upper deck; 10. forecastle deck and poop deck; 11. vertical posts which are linked together by either wires or tubes
- III. 1.F; 2.T; 3.T; 4.F; 5.T; 6.F
- IV. Countable and uncountable nouns
- | | |
|---------|---------------|
| Flat | accommodation |
| Desk | furniture |
| Bag | luggage |
| Job | work |
| Trip | travel |
| Problem | trouble |

4. Conclusions

I have been using this manual for five years and I have had a feed-back from both my students and my peers

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6. What is the purpose of the double bottom tank?
7. How do you call the deck covering the top of the hull?
8. What is a bulwark?
9. How do you call the decks which are forward and aft above the upper deck?
10. What are guard stanchions? 10p

III. Are these statements TRUE(T) or FALSE(F). Select the correct answer.

1. The lowest of the four decks of the superstructure is called the upper bridge deck. T/F
2. Above the saloon deck is the boat deck. T/F
3. The highest deck in the superstructure is called the navigation deck.T/F
4. The bridge deck is where the ship is steered or conned from. T/F
5. The galley is the ship's kitchen. T/F
6. The crew's quarters and the galley are on the boat deck. 6p

Trouble/information; 7. Fact/information; 8. Chance/luck; 9. Advice/suggestion; 10. Knowledge/capability; 11. News/headline; 12. Dollar/money; 13. Hour/time; 14. Scenery/landscape. 14p

6. I think it's a pity Rebecca had her hairs cut short because she looked much more attractive before.
7. As an old friend, may I give you an advice?
8. It's not a bad room but the furnitures take up too much space.
9. If we don't have up-to-date information, how can we make sensible decisions?
10. Fortunately, the check-up was less unpleasant experience than I had expected.
11. All the luggages are here in the corridor.
12. Peter doesn't like milk in his tea.

| | |
|------------|-------------|
| Fact | information |
| Suggestion | advice |
| Dollar | money |
| Landscape | scenery |
| Chance | luck |
| Capability | knowledge |
| Headline | news |

- V.
3. ..the traffic is terrible...
 4. because of bad behaviour...
 5. **RIGHT**
 6. Rebecca had her hair cut short
 7. I give you some advice/ ... a piece of advice?
 8. the furniture takes up too much space
 9. **RIGHT**
 10. was a less unpleasant experience
 11. the luggage
 12. **RIGHT**

who found it very helpful: the teachers for teaching and the students for learning the specialist terminology. If changes might occur in the specialist area, the manual will be upgraded to suit the students' needs.

RISK FACTORS AND SAFETY AT WORK IN POTENTIALLY EXPLOSIVE ENVIRONMENTS

Nicolae BARBU¹

¹ Comisar șef de poliție, drd., Inspectoratul de Poliție al Județului Constanta

Abstract: *A special class of substances or mixtures of substances, generically called explosives contain both fuel and oxidants but necessary chemical reaction of oxidation-reduction and therefore no longer need outside stimulation for only the voluntary triggering the explosion. In their military or civilian applications, explosive materials must operate and release their energy "chemical potentially explosive" only after the desired action, voluntary and does not accept their accidental initiation. However, we can not say that there is or there are no accidents with explosives or explosive devices. Their consequences are often unexpected and always destructive, resulting in material losses and casualties.*

Key words: *risk management, risk procedures, safety management*

1. General

Nowadays, when the industrial civilization is facing more and more with the importance of human problems and the human intrinsic value, safety and health is an issue of particular importance.

Every year, a great number of accidental explosions occurred in various industries as a result of accidental initiation of explosion mixtures formed accidentally. Many gaseous materials, with liquid or solid fuel properties may be blended or dispersed into the atmosphere and thus can be easily opened and explode. These phenomena are common in underground mines where methane-air mixtures have as a result several victims or serious injuries.

2. Provisions and regulations regarding the control of major accident risks

On February 3, 1999, was implemented by the EU countries the European directive 96/82/CE from December 9, 1996., regarding the major risk management that involve dangerous materials, called Seveso II.

In Romania, the directive 96/82/EC was implemented by:

- Government Decision no. 804 from August 8, 2007 on the control of major accident hazards that involve dangerous substances;
- OM no. 142 from February 25, 2004, for the approval of the procedure for the assessment of the security on the activities which involve the production of major accident hazards that involve dangerous substances;
- OM no. 251 from March 26, 2005 for the organization and the functioning of the secretariats of risk control activities that present hazards of accidents that involve dangerous substances;

3. General principles in evaluating the risks of the accidents with accidental and occasional explosives

3.1. Introduction

Making the operations and the activities with explosive mixtures in terms of accidental occurrence (gaseous, liquid or aerosol) is always associated with the risk of occurrence of accidents and hazards, generically known as explosive accidents.

The risk is the result from the consequence/gravity of the accident and its probability of its occurrence. It represents an assessment (qualitative or quantitative) when an accident or incident occurs or may occur and assumes all actual or potential circumstances that may cause injury, the death of the employees or to bring damage to the equipment and the supplies or even their loss. [1]

3.2. General principles of explosive security

The objective of any health and safety activities at work is to limit the risks to acceptable limits. [5] In the field of explosive risk activities 4 basic principles of security have been formulated, the last three being set since 1925 by Varin-Bohan.

4. The procedure for assessing the risks of explosive accidents

The overall purpose of a safety study in potentially explosive atmospheres is to identify risks, assess the likely consequences of accidents and frequency and finally to establish technical and organizational measures that lead to

Integrated occupational safety at work in potentially explosive atmospheres is translated through a knowledge of the properties of raw materials, finished products, processes, facilities and devices used during operations with potentially explosive and dangerous substances: **working with unknown substances is not safe, especially in what concerns their behavior in different environmental conditions in which they can decompose or oxidize, the way in which the oxidation and its explosion effects.** It is therefore necessary for each type of fuel, mixture that is potentially explosive, chemical substances with dangerous properties, to have or to develop the security information statement.

- OM no. 647 from May 16, 2005 for the approval of the Detailed Rules on making contingency plans in case of accidents that involve dangerous substances;
- OM no. 1299 from December 23, 2005 regarding the approval of the inspection procedure for presenting the objectives of producing major accident hazards that involve dangerous substances;
- OM no. 1084 from December 22, 2003 regarding the approval of the procedures for the notification of the activities which are producing major accident hazards that involve dangerous substances and accidents;
- OM no. 520 from May 29, 2006, regarding the approval of the procedure for investigating the major accidents that involve dangerous substances

This document covers steps for the prevention of major accidents that involve dangerous substances, and limiting their consequences for the health of people and for the environment, to ensure a high level of protection, in a coherent and effective way. [2]

A. Principle 1: knowing the risks

Like the explosive materials, explosive mixtures are accidental hazardous materials. These can be characterized by physical, chemical, thermodynamic, sensitivity and stability, behaving in different ways under certain conditions of climatic, mechanical and electrical environment.

B. Principle II: separating the risks

In accordance with this principle there can be accepted at a workplace only jobs that imply similar risks and different risks.

C. Principle III: limiting the risks

Performing tasks in potentially explosive atmospheres requires the existence of combustible substances and air or other oxidizing. Since the likelihood of explosive mixtures and explosive events can never be zero risk, it can never be eliminated. Therefore, risks should be limited.

D. Principle IV: overlapping safety devices

When installing the work points, equipment layout and work organization should overlap safety devices. This principle was set out early in 1920 and was well applied from Chatelier before being set out.

the cancellation of the business risks. However, activities with potentially explosive materials or explosive systems makes this impossible. In this case, the main purpose is to reduce, mitigate risks to an acceptable level. For this, after risk analysis, risks will be identified in order to find a solution in order to limit and protection measures will be taken, or measures in order to limit them.

4.1. The definition of Risk

Risk is the product of the severity of an accident and the probability of occurrence of the accident.

The seriousness or the severity of the accident

To provide a qualitative assessment of the effects of personnel error, environmental conditions, inadequate

design, procedural deficiencies, the fall of the system components or of the subsystem, or a system malfunction that resulted in an explosive accident, the concept of seriousness (severity) of the accident is introduced. The descriptions of the categories are shown in the table below.

Table 1 The categories of the gravity of the accident

| DESCRIPTION | CATEGORY | DEFINITION |
|-------------|----------|--|
| DISASTER | I | Death or loss of the system. |
| CRITICAL | II | Serious injury, severe professional illness or major damage of the system. |
| MEDIUM | III | Injury and medium damage, with consequences between major and marginal. |
| MARGINAL | IV | Minor injury, minor professional illness or minor damage of the system. |
| NEGLIGIBLE | V | Injury, professional illness or less minor damage of the system. |

The probability of occurrence of the accident

The likelihood of an explosive accident can be described as the possibility of occurrence of an event per unit time, the events, the people, issues or activities. The combination of quantitative magnitudes of the possibility of occurrence of the accident, before the event to occur is generally impossible. It is possible to give values of

probability of occurrence of events by statistical means, which interprets and processes data from the history or events over time, appeared similar to systems analysis. Rational support for assigning a probability of occurrence of risks should be documented in reports of risk analysis. An example of classification of the likelihood of accidents is presented below in Table 2.

Table 2 The probability of occurrence of accidents

| DESCRIPTION * | LEVEL | DEFINITION | FOR A RANGE OF MATERIALS ** |
|---------------|-------|---|----------------------------------|
| FREQUENTLY | A | Likely to occur in a frequent way | Experimented in a continuous way |
| PROBABLY | B | It will happen a few times in life | It will frequently occur |
| OCCASIONAL | C | It will probably occur sometimes during life | It will occur a few times |
| ISOLATED | D | Unlikely, but likely to occurrence in life | Unlikely, but may occur |
| UNLIKELY | E | It can happen so rarely that it cannot be experienced | Unlikely, but possible to occur |

* The definitions of descriptive words may need to be adjusted, based on the quantities involved.

** The size range of materials must be specified.

Risk assessment

Risk assessment requires making the product of the magnitude of the accident or undesired event and its likelihood of occurrence. Subsequently, the question arises as to limit those risks to acceptable levels. If there is no solution

to reduce or to limit their risk to acceptable levels, then other activities that do not impose these risks are recommended. Risk assessment can be made using a risk matrix as the one presented in Table 3

Table 3 Risk assessment matrix

| FREQUENCY | ACCIDENT SEVERITY | | | | |
|------------------|-------------------|----------------|---------------|-----------------|------------------|
| | I CATASTROFIC | II CRITICAL | III MEDIUM | III MARGINAL | IV NEGLIGIBLE |
| (A) FREQUENTLY | 1A | 2A | 3A | 4A | 5A |
| (B) PROBABLY | 1B | 2B | 3B | 4B | 5B |
| (C) OCCASIONALLY | 1C | 2C | 3C | 4C | 5C |
| (D) ISOLATED | 1D | 2D | 3D | 4D | 5D |
| (E) UNLIKELY | 1E | 2E | 3E | 4E | 5E |

THE SUGGESTED RISK ACCEPTANCE CRITERIA

1A, 1B, 1C, 2A, 2B, 3A unacceptable

1D, 2C, 2D, 3B, 3C, 4A, unwanted (SSM responsible decision is required)

1E, 2E, 3D, 3E, 4B, 4C acceptable, with the observations of the SSM responsible

4D, 4E, 5A, 5B, 5C, 5D, 5E acceptable without any comment

4.2. The classification of the operations with potentially explosive materials

Operations with combustible materials or potentially explosive mixtures involve the exercise of their external applications or the application of external stimuli (mechanical action, thermal action, electric discharge or electrostatic, etc.). These applications can be characterized by an amplitude (size) and a duration of the action. To characterize the overall concept of these applications, the term aggression is used.

The likelihood of an accident while carrying out an operation in potentially explosive atmospheres can be measured from the reference level (level 1 or aggression of gravity 1) and taking into account the following:

- the aggressions which aerosol explosive material may be exposed, both in terms of frequency and in terms of amplitude or intensity;
- the sensitivity of the product or of the explosive mixture on aggression actions:

- Assessing the sensitivity resulting from the experimental results of flammability tests, whose values appear in files with data security, the information presented in documents with the outcome of product development research;

- It can be inferred from theoretical studies or comparisons made with the results obtained for similar products.

4.3. The probability of occurrence of an incident or the degree of probability

Next, the likelihood of accidents or degrees of probability will be presented, depending on the levels of aggression faced by materials or the explosive devices, according to their sensitivity or flammability.

B. The probability of occurrence of an explosive accident

For each workstation and each individual plant, depending on the nature of flammable materials or hazardous substances that can be found at work, and the type of operation to be carried out, the likelihood of an explosive accident must be assessed and approved as P1, P2, P3, P4, P5 depending on how it may occur: extremely rare, very rare, rare, quite often or frequently.

The likelihood of an explosive accident must be estimated in a sufficiently realistic way for each of the elementary facilities and private materials used in the process.

A. The degrees of probability

| The level of aggression: | | | | | | |
|---|-----------|-----------|-----------|-----------|-----------|-----------|
| 6 : An operation or a phase of an operation involving a mechanical action, heat or electricity that is aggressive near flammable materials and substances | | | | | | |
| 5 : leading or involving the use of tools or mechanical or electrical processing equipment or part of the operation, involves a mechanical or electrical action less aggressive on the materials and on the flammable substances | | | | | | |
| 4 : The operations or parts of operations that require or involve external energy input, other than the mechanical energy of materials and of flammable substances | | | | | | |
| 3 : The transport, the handling and the manipulation of materials and flammable substances in packages which are not approved or unpackaged | | | | | | |
| 2 : The transport and the handling of materials and of flammable substances in containers approved for transport | | | | | | |
| 1 : The storage of materials and of flammable substances under appropriate conditions for these materials | | | | | | |
| Material or explosive device | | | | | | |
| Material 1 : Substance or mixture of fuel substances / extremely sensitive oxidant / flammable | P2 | P2 | P3 | P4 | P4 | P5 |
| Material 2 : Substance or mixture of fuel substances / very sensitive oxidant / flammable | P1 | P1 | P2 | P3 | P3 | P4 |
| Material 3 : Substance or mixture of fuel substances / sensitive oxidant / flammable | P1 | P1 | P2 | P2 | P2 | P3 |

To allow a certain diversification of opportunities to place the installations in the dangerous locations, there have been designed that there are 5 degrees of probability of

occurrence of accidents that can be achieved: P1, P2, P3, P4, P5. Their characteristics are shown in the table below.

Table 4 The probability of occurrence of explosive accidents

| The degree of probability | Observations |
|---------------------------|--|
| P ₁ | P1 should normally correspond to an annual probability of less than 10.4 pyrotechnic accident. |
| P ₂ | P2 should normally correspond to an annual probability of fireworks accident at least 10.4 but less than 10.3. |
| P ₃ | P3 should normally correspond to an annual probability of fireworks accident at least 10.3 but less than 10.2. |
| P ₄ | P4 should normally correspond to an annual probability of fireworks accident at least 10.2 but less than 10.1. |
| P ₅ | P5 should normally correspond to an annual probability of fireworks accident at least 10.1. |

4.4. Risks to be prevented and dangerous areas

A Classification of hazardous areas

Within each workstation or job located outdoors or in a building, isolated or part of a local warehouse, warehouse containing materials or mixtures that may form potentially explosive mixtures, hazards occur as a result of the presence of these types of materials.

Depending on the total quantity of material that can create explosive mixtures or potentially explosive aerosols, it is possible to classify the areas of danger in 5 categories, according to the seriousness of the consequences of the accidents for the persons or for the material goods.

| Categories of dangerous areas | Z ₁ | Z ₂ | Z ₃ | Z ₄ | Z ₅ |
|-------------------------------|--|---|--------------------------|---------------------------|--------------------------------------|
| Injuries on people | Fatal injuries in more than 50% of the cases | Serious injuries that can even lead to the loss of life | Injuries | The possibility of injury | Reduced possibilities of mild injury |
| Degradation of material goods | Extremely serious damages | Important damages | Medium and light damages | Light damages | Very light damages |

CONCLUSIONS

In the economy of each country, for industrial, agricultural, transport, storage activities and even for domestic activities, many combustible solid, liquid, gas or combinations of materials are used. Many of them are raw materials for manufacturing and some are finished products for consumption. Whatever the type or the chemical composition of these materials, fuel / petrol is designed to provide, in combination with oxygen in the air or other oxidizing, thermal effects, strong heated reaction products, at temperatures and pressures that allow them to later perform different actions: propulsion, thermal etc. Accidental explosive mixtures cover all states of aggregation of the material. They can be aerated and generally consist of mixtures of fuel gas with air, without excluding the combination with other gases. They can be mixtures of volatile liquids, flammable with the air and not least, they can be made of solid fuel, more or less divided in powder form, in mixtures with the air - creating aerosols or in warehouses, the air broadcasting among solid particles.

In all the situations and the types of chemical combinations, accidental explosive mixtures have demonstrated the full virulence explosion effects by the severity of the accidents, measured by property damage, personal injury and even death of hundreds or even thousands of people.

An accidental explosion proved to be more dangerous than the accidental explosion of explosive material for several reasons:

- in what concerns the accidental explosive mixtures, it may not be aware the fact that the mixtures of explosive materials have properties or the circumstances in which they may

become dangerous, e.g. in a store of grain, starch dust suspended in air can be ignited by a short electrical circuit;

- changing the process parameters can lead to the increased likelihood of developing accidentally mixtures, for example the increase the speed of conveyer belts can cause the necessary turbulence for the potentially explosive aerosol ;
- the ignorance of the conditions in which accidental explosions appear results in the number of persons on the workstation an not being limited;

The accident occurs in a technological operation, transport, storage or preserving, preparation, processing, loading, contrary to our will or what we expect, of accidental explosive mixtures, and the explosion that can occur may have adverse consequences (property or physical damage , up to the death of people).

The purpose of this paper is to present the first major elements of health and safety at work, imposed by the various national and international resolutions to several industrial operators and to define the exact scientific principles of safety and explosive safety in this area.

The risk assessment procedure is based on the classification of the materials that can generate accidental explosion and then to determine the probability of occurrence depending on the flammability and the aggression. Dangerous areas are classified according to the severity of the consequence of the accident.

After highlighting the technological activities or operations involving casual or accidental explosives, the risk factors are presented in the specific area of work in potentially explosive atmospheres, offering methods and techniques for limiting the risk of an explosive nature.

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TOBACCO CESSATION

Aurel BEJAN¹

¹Lector universitar dr., Academia Navală „Mircea cel Bătrân”

Abstract: Tobacco use can be a hard habit to break because nicotine is physically addicting. You experience a craving for tobacco. The force of habit is strong. Tobacco use may seem an indispensable part of your daily life. However, you can quit if you are willing to put forth the effort. Millions of people have done it. In fact, one out of three tobacco users who attempt to quit, succeed in quitting.

Key words : Health, smoking habits, prohibited, effects, physical tests

TRAINING OBJECTIVE

- A. Identify the effects of tobacco use
 B. Indicate reasons for tobacco use/nonuse
 People have tried a variety of ways to quit, including:
 1. Methods of quitting: acupuncture, behavior modification, behavior modification, rubber bands, hypnosis, nicotine

How many people smoke? Approximately twenty-eight percent of the American population smokes. This is down from the over 50% rate reported during the 1950s and 60s. It is estimated that approximately 28% of American males and 30% of American females smoke. This contrasts with much higher rates found in other countries. The goal for

1990 is to reduce the rate of smoking to 25% and to near zero by the year 2000! Among Army personnel the rate of smoking has been well over 50% as recently as 1985 it now appears to have dropped to 41% (1998). This has been higher than any other service branch. By grade, we have found an alarming 63% of those in grades E7-E9 smoking!

- Smoking rates
- 30% of American males smoke
 - 55% of French males smoke
 - 70% of Japanese males smoke
 - 16% of Japanese females smoke
 - 32% of American females smoke
 - 63% of Romanian males smoke

Comparison of smoking habits between Army males and Romanian population total males:

| | Army | | Romanian population | |
|----------------|------|--|---------------------|--|
| 1. smokers | 52% | | 28% | |
| 2. non-smokers | 48% | | 72% | |

The department of the Army established policy regarding smoking. The following specific guidelines apply:

- Notice will be displayed at entrance to Department of Army occupied space which states that smoking is not allowed, except in specifically designated areas.
- Smoking areas may not be designated within auditoriums, conference rooms, classrooms, restrooms, gymnasiums, fitness centers, and elevators.
- Smoking is prohibited in all military vehicles and aircraft

- Nonsmoking areas shall be designated and posted in all eating facilities in occupied buildings
- When individual living quarters are not available and two or more individuals are assigned to one room, smoking and non-smoking preferences shall be considered in the assignment of rooms
- Health care providers shall not smoke in the presence of patients
- Smoking by students is prohibited on the grounds of Dependent Schools
- Smoking is prohibited where it presents a safety hazard.

EFFECTS OF TOBACCO USE

Smoking affects your health in many ways. As soon as you light up, changes occur in your body

A. immediate effects: your heart speeds up, your senses are dulled, air passages in your lungs constrict, your skin

temperature decreases, carcinogens and toxic gases enter your bloodstream.

Obviously smoking affects your physical performance. Students who smoke perform less well on the Naval Academy Physical Fitness Test and the more they smoke, the poorer the performance.

B Cigarette smoking and performance on the Naval Academy physical tests:

| | Smokers (n=97) | | non-smokers (n=50) | |
|----------------|----------------|--|--------------------|--|
| Age(yrs) | 19.4 | | 20.4 | |
| Ht (cm) | 176.6 | | 178.0 | |
| Wt (kg) | 71.6 | | 76.9 | |
| Bf (%) | 17.2 | | 19.1 | |
| Pu (reps) | 46.8 | | 53.6 | |
| Su (reps) | 56.0 | | 62.5 | |
| 2-mi (min:sec) | 14.40 | | 14.17 | |

C. Number of cigarettes smoked and performance on the Naval Academy physical tests:

| | Less than 10 (n=14) | | 11-12 (n=24) | | 21-30 (n=11) | |
|----------------|------------------------|--|-----------------|--|-----------------|--|
| Age(yrs) | 20.8 | | 19.3 | | 21.4 | |
| Ht(cm) | 178.7 | | 176.1 | | 174.8 | |
| Wt (kg) | 76.9 | | 71.4 | | 66.3 | |
| Bf (%) | 18.9 | | 15.8 | | 18.1 | |
| Pu (reps) | 52.3 | | 44.1 | | 43.5 | |
| Su (reps) | 60.1 | | 52.8 | | 49.3 | |
| 2-mi (min:sec) | 14:30 | | 15:18 | | 14:44 | |

| | Smokers (n=463) | | non-smokers (n=202) | |
|-----|-----------------|--|---------------------|--|
| Age | 21.3 | | 20.5 | |
| Ht | 173.0 | | 172.5 | |
| Wt | 72.3 | | 72.2 | |
| Bf | 19.5 | | 20.1 | |
| Pu | 33.8 | | 36.0 | |

| | | |
|-------|-------|-------|
| Su | 50.3 | 54.4 |
| 2-min | 16.08 | 15:28 |

D. Cigarette smoking and performance on the Naval Academy physical tests:
 Males and females

| | Males (smokers/nonsmokers) | | Females (smokers/nonsmokers) | | |
|------|----------------------------|-------|------------------------------|-------|-------|
| age | 21.5 | 20.5 | age | 19.2 | 20.2 |
| ht | 175.0 | 175.0 | ht | 162.6 | 162.8 |
| wt | 74.5 | 75.2 | wt | 60.7 | 60.3 |
| bf | 17.8 | 18.0 | bf | 27.8 | 28.1 |
| pu | 36.8 | 40.2 | pu | 18.9 | 19.5 |
| su | 50.4 | 54.9 | su | 49.9 | 52.6 |
| 2-mi | 15:35 | 14:43 | 2-mi | 18:59 | 18:20 |

Smoking can cause serious diseases which may result in disability or death. Smokers have up to ten times more risk of developing these diseases than non-smokers. The more you smoke, the greater the risk.

Smoking cigarettes:

1. harms your health and shortens your life
2. costs you money
3. is unattractive and unpleasant, harms others

Even non-smokers suffer the consequences of smoking when placed into smoke-filled area.

The non-smokers

Spend

Inhale

- | | |
|-----------------------|--------------------------|
| 2 hrs in a bar | 2 low-tar cigarettes |
| 8 hrs at the office | 3 low-tar cigarettes |
| 2 hrs at the office | 2/3 low-tar cigarette |
| 4 hrs in a party | 2 1/2 low-tar cigarettes |
| 4 hrs in waiting room | 1 1/3 low-tar cigarettes |

In addition, the long-term (chronic) effects of smoking can be devastating. Smokers suffer from more respiratory diseases, cancers, and heart diseases. In fact, the number one killer of smokers is not lung cancer, but heart disease.

Long-term effects

1. respiratory diseases: chronic bronchitis, emphysema, lung infections
2. cancers: lung, larynx, mouth, throat, esophagus, kidney, pancreas, bladder
3. heart diseases: kills more smokers than lung cancer

Of additional concern is the growing number of people who use smokeless tobacco, however, many people who chew tobacco and dip snuff do not know that it is bad for them. Unfortunately, smokeless tobacco is not a safe alternative to smoking and using smokeless tobacco can cause:

Smokeless tobacco

1. mouth and throat cancer
2. tooth decay and receding gums
3. bad breath and discolored teeth
4. less sense of taste and smell

When you quit smoking, you will feel better both physically and psychologically because:

- A. You'll breathe easier

- B. Your sense of taste and smell will improve
- C. You may have more energy
- D. You'll save money
- E. Your lungs will work better
- F. Your heart won't have to work as hard
- G. You may have more confidence
- H. Others won't be disturbed
- I. Risks eventually decrease

There are many ways to quit. Each user must find the best way to break his or her personal habit. One way is to obtain outside help. You have a wide choice of methods and sources. For example: Get outside help: group programs, commercial plans, behavior modification, counseling, medical treatment, hypnosis

Another way to quit is to do it yourself. If you decide to quit on your own, you can either cut down gradually, or you can quit "cold turkey". Whichever method you choose, be prepared with a positive attitude and more confidence in your will power. Tell yourself you have the strength to overcome the tobacco habit. The following are the different ways smokers have actually used in retraining themselves to live without cigarettes.

Tips

1. wrap your cigarettes
2. plan a date for stopping
3. don't store up on cigarettes
4. never carry matches/lighters
5. take a shower
6. smoke only half your cigarette
7. others

Remember that the environment surrounding you is very important when you quit smoking

Smoking environment

Do you want to change your smoking habits

Why do you smoke?

Quitting plans A and B

How do you maintain your will and stay away from tobacco after you quit? Some suggestions on how avoid slipping off your program include:

1. Slippage control: exercise, social activities, busy work, substitutions crafts/hobbies, relaxation techniques

TOBACCO CESSATION

Do you want to change you smoking habits?

For each statement, circle the number that most accurately indicates how you feel. For example, if you completely agree with the statement, circle 4. if you agree somewhere, circle 3, etc.

IMPORTANT: Answer every question

| Nr. | question | Completely agree | Somewhat agree | Somewhat disagree | Completely disagree |
|-----|--|------------------|----------------|-------------------|---------------------|
| A | Cigarette smoking might give me a serious illness | 4 | 3 | 2 | 1 |
| B | My cigarette smoking sets a bad example for others | 4 | 3 | 2 | 1 |
| C | I find cigarettes smoking to be a messy kind of habit | 4 | 3 | 2 | 1 |
| D | Controlling my cigarette smoking is a challenge for me | 4 | 3 | 2 | 1 |
| E | Smoking causes shortness of breath | 4 | 3 | 2 | 1 |
| F | If I quit smoking cigarette, it might influence others to stop | 4 | 3 | 2 | 1 |
| G | Cigarettes cause damage to clothing and other personal property | 4 | 3 | 2 | 1 |
| H | Quitting smoking would show that I have willpower | 4 | 3 | 2 | 1 |
| I | My cigarette smoking will have a harmful effect on my health | 4 | 3 | 2 | 1 |
| J | My cigarette smoking influences other close to me to take up or continue smoking | 4 | 3 | 2 | 1 |
| K | If I quit smoking, my sense of smell would improve | 4 | 3 | 2 | 1 |
| L | I don't like the idea of feeling dependent on smoking | 4 | 3 | 2 | 1 |
| M | If I quit smoking, I would feel better and have more energy | 4 | 3 | 2 | 1 |

How to score:

A + G + H = Stimulation

B + H + N = Handling

C + I + O = Pleasurable Relaxation

D + J + P = Crutch; Tension reduction

E + K + Q = Craving; Psychological addiction

F + L + R = Habit

Smoking

PLAN A CHARACTERISTICS

- on the night before you quit, go to bed and get plenty of rest
- throw away all of your cigarettes and smoking materials
- for the next two weeks, eliminate all alcohol, caffeinated drinks like coffee, tea and colas, spicy foods, rich desserts, pastries and candy
- also for the next two weeks, stay away from your smoking friends and smoke-filled spaces as much as possible
- drink lots of water and fruit juices for the next 2-3 days: at least 8-10 glasses a day
- find something to occupy your hands and your mind
- find substitutes for smoking that can keep mouth busy.

PLAN B CHARACTERISTICS

- Throw away your cigarettes and only but one package at a time
- begin to record your smoking habits. Rate the smokes you feel you just cannot do without, with the number “1”. A number “2” means you want the

cigarette but not desperately, and a “3” means you really could do without it relatively easily. Copy the daily cigarette count sheet into another piece of paper and wrap it around your cigarette pack. Secure it with rubber bands. Remember to record the facts before you light up. Make several copies of the sheet and use a different one for each day.

- on successive days don't smoke any of the cigarettes you rate “3”
- keep rating your cigarettes and continue to avoid the least needed ones. Smoke the rest
- add nutritional support and continue it through the program
- by day 4, begin to eliminate your number “2” cigarettes
- by day 5, eliminate the rest of the number “2” cigarettes
- by day 6 & 7, begin cutting down on the cigarettes that are most important to you.
- by day 8 & 9, each day cut out more of the half-cigarettes you are smoking
- by day 10 (“Q”), throw all your remaining cigarettes and smoking materials away.

Conclusion

Smoking can cause serious diseases which may result in disability or death. Smokers have up to ten times more risk of developing these diseases than non-smokers.

The more you smoke, the greater the risk. Smoking affects your physical performance. Students who smoke perform less well on the Naval Academy Physical Fitness Test and the more they smoke, the poorer the performance.

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PARTICULARITIES OF SEAFARERS AND CADETS RECRUITMENT IN MARITIME TRANSPORT

Paul BOCANETE¹

Cristina NISTOR²

Alina BREAZU³

¹Prof. univ. dr., Constanta Maritime University, Constanta

²As.univ.dr., Constanta Maritime University, Constanta

³Prep. univ. drd. Constanta Maritime University, Constanta

Abstract: *This paper presents the particularities of seafarers and cadets recruitment in maritime transport as observed at some crewing companies. Recruitment represents the process of screening and selecting qualified people for a job. Choosing the right person is essential for maritime companies. Therefore, it is vitally important to choose the adequate skills and qualities needed to ensure recruitment of suitable candidates. Observing the leadership skills, in particular, plays a strategic role in the process of recruitment.*

Key words: *maritime transport, seafarers, cadets, crew.*

1. Introduction

The total number of EU nationals employed on board ships flying the Community flag is currently 120 000, down by 40% as compared with 1985, whereas the number of nationals of non-member countries employed on board EU ships has risen from 29 000 in 1983 to 34 500 today.

Several sociological and financial factors explain the lack of attraction of this profession for young Europeans. Between 1992 and 1999 the monthly average salary for qualified seafarers fell by 53% for the Germans, 51% for the Belgians, 49% for the Dutch and 26% for the Portuguese and 14% for the French. Separation from their families and friends is less and less accepted by potential young recruits and the scope for visiting exotic places has disappeared since ships only make short calls or indeed remain outside the port for their commercial operations. Thus the drop-out rate during

2. Particularities of Recruitment of seafarers and cadets in Maritime Transport

Recruitment refers to the process of screening and selecting qualified people for a job.

The basic qualities required of all seafarers never change, but each trade has its own particular skills. For example, passing Black Sea with a cruise ship is different than passing Panama Canal with a VLCC. Therefore, different requirements should be sign in the application forms used in the recruitment process. Recruitment of seafarers can be made from an existing pool of internationally trained seafarers due to expansion of the company, promotions, study leave, retirement or sickness. Not every company has its own policy of recruitment. Historically, international shipping companies with tradition have their own „cadet” programmers to ensure a progression through ranks of seafarers who had grown up with the company’s culture. This method of replacement has diminished over the last decades and nowadays companies use to outsource and collaborate with crewing companies. The benefit to the owner is a reduction in office overhead but the negative affect might be the lack of loyalty from the trainee.

According to H. Holman, in *Handy Book for Ship owners and Masters*, written in 1964 „to secure a high degree of success as a senior officer, a person must possess a rare combination of qualities. He must be physically sound and strong with a personality capable of commanding the necessary degree of confidence and willingness to obey on the part of his subordinates. He must be morally strong seeing that failure in an emergency so often results in disastrous consequences. No amount of experience will compensate for a lack of nerve and will power and self-restraint.”

Training will help improve the skills of any seafarer, but no manner of training helps if is selected the wrong person. Therefore, it is essential to carefully choose the qualities expected from the suitable candidate for the task. In every successfully maritime company there is a sense of belonging for seafarers. Instead, in poor rated companies, crews are only motivated by money. Objective of recruitment is to find the best available candidates, with the lowest costs

training at sea lies between 22 and 32% and reaches 60 or 70% in certain Member States.

During financial crisis, when faced with growing competition, ship owners have decided to cut their costs by registering their ships under non-Community flags and replace European seafarers by cheaper third-country labor.

This growing shortage of seafarers could have a dramatic impact. First of all in terms of safety, since 80% of accidents are due to human error, and that third-country staff are in general terms less well trained. Then, for a whole series of activities linked with transport (ports, maritime-shiping companies, inspection bodies, insurance companies) which could face recruitment difficulties in that experience in sea-faring matters is an advantage or a prerequisite for job applicants.

of search. This process begins when the new candidates are searched for and ends when the candidates have presented their recruitment files and résumés.

Business environment changes quickly and there appear new needs of personnel qualifications and new ways of increasing the productivity. The growth and diversification of maritime activities has lead to an increase and an evolution of threats; this new situation requires the consideration of individual threats (navigation, accidents, terrorism, immigration, illicit traffic and pollution) and environmental threats (natural resources and disasters). In such environment, competitive seafarers are the ones who are well trained, accept a low level of risk and are responsible with their work and with the marine environment. A maritime company can keep a competitive advantage for medium and long term, by focusing on human resources strategies that can reach the following specific actions: the human resources orientation over client, maintaining the transparency of information needed all over the human resource department, opening and keeping new communication channels, improving communicational climate, both formal and informal, developing professional abilities and interpersonal communication skills (cooperation, improving motivation and dealing with emotions in organizational behavior, team work, etc) of the human resource. A personnel strategy in maritime transport may include a large perspective and a dynamic vision over human resources, influenced by the fact that in most cases crews are multinationals. An important element is the definition of the general objectives for medium and long term concerning human resources strategies. For establishing its own personnel strategy, a maritime company might consider increasing the efficiency of the transport services on the national and international markets to get a higher profitability, cooperation with educational institutions, crewing companies and HR companies specialized in providing professional training services. Maritime company should have quality assurance procedures that specify and define each and every rank on board. The working contract between the owner and employer of the seafarer should refer to these procedures as being the minimum standards the employing company needs to achieve when recruiting seafarers.

3. Recruitment criteria

Recruitment criteria refer to the following: criteria from the company's point of view and criteria specific to the rank. The basic criteria from the company's point of view include: the type of vessel, the trading pattern, the type of manning to be used, the relief pattern to be implemented, the international regulations that need to be complied with, the flag regulations, the ability to speak English language and the salary scales to be used. The criteria specific to the rank refers to the minimum certificate needed, endorsements, previous experience, duties involved, qualifications, aptitudes required, special skills etc.

4. Conclusions

In the context of the complexity of the global labor market, recruitment of the best needed seafarers and cadets represent one of the most essential strategies for a maritime company. The recruitment process in maritime transport is the main process to bring new seafarers to the company. In today context, when approximately 80% of sea accidents happen due to human error, a highly importance must be paid to recruitment in order to maintain quality and safety of maritime operations. Apparently, the process of recruitment and

Cadet recruitment can be divided into two methods of approach: in-house recruitment and through a crewing agency. These systems of recruitment apply worldwide, depending upon local conditions. In-house cadet recruitment involves recruitment at universities, technical colleges and advertising in mass-media or on websites. Upon receiving a request from someone wishing to serve as a cadet, an application form is sent out and after completion is returned to the company for processing. After processing, letters of acceptance or regret, with explanations, should be sent to all applicants. In the next step of recruitment process, suitable persons are invited to attend an interview, in order to be selected most suitable persons.

seafarers' selection seem easy, but in reality there are no easy recipes for the success of this process, as it depends on the knowledge and skills of the ones involved.

A maritime company striving for excellence must take into consideration that multinational teamwork, collaboration, communication and rewards for excellence contributes to developing commercial and risk management skills and provide a competitive advantage for the human resources.

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USING VIDEOS IN TEACHING ENGLISH

Lili BUZATU¹
Liana ROBU²

¹ Prof def. Academia Navală “Mircea cel Bătrân” Constanta

² Prof def. Academia Navală “Mircea cel Bătrân” Constanta

Abstract: *Although disregarded for many years, using videos in an English course has been extensively used recently as a source of authentic material and an interactive way to introduce particular language points that need to be practiced in classroom. Videos play an important part in teaching and learning a foreign language, as they employ real-life situations with real-life expressions and other particularities. Being a great resource to use in class there are an endless number of ways to exploit them to create motivating, memorable classes with a high level of language production. However the disadvantages should not be disregarded but turned into prolific English teaching classes.*

Key words: *Videos, teaching, English*

1. Introduction

As the approaches to teaching foreign languages take more and more distance from the traditional methods, new ways of presenting and practising the acquired skills emerge. The use of videos in class is gaining more ground as an effective way to vary activities and to avoid the routine in class. People seem to no longer find pleasure in reading books so taking advantage of the development of technology comes handy to English teachers. Both songs and videos are widely used in teaching and learning a foreign language, as they employ real-life situations and real-life language. The

main difference between songs and videos is that in the latter, the sense of seeing is also involved. However, just watching TV does not account for teaching English, because it's all there, the pictures, the characters, the script, leaving very little left for our imagination. It is up to the teacher to find and make use of the different ways of exploiting a video. While some of the classroom activities encourage discussions, others focus on specific vocabulary development or listening tasks. Students really enjoy watching movies and TV for a variety of reasons, one of them being that they are exposed to natural language in a non-threatening setting.

2. Advantages and Disadvantages of Using Videos

There are a number of good reasons to use videos in English classrooms. As a mixture of both visual and audio components, videos are accessible to most of the students, and provide context for learning. For English language learners, videos provide real language and cultural information. Videos can be controlled (stopped, paused, repeated), and they can be presented to a group of students, to individuals, or for self study. Understanding of language is at a higher level due to the fact that the learners see facial

expressions and body language at the same time as they hear the stress, intonation, and rhythm of the language.

Since most videos are produced as a means of entertainment for native English speakers, they generally present real language that is not simplified and is spoken at a normal speed with genuine accents. These videos include movies, television programs, and news broadcasts. They can provide new cultural information, and can motivate learners to deepen their level of comprehension. Apart from the videos mentioned above, one should not overlook the instructional videos. The latter have been created for use in classrooms or

in other educational settings and have additional advantages. They have already been assessed in terms of language, content, and length, and many of these videos come together with student workbooks, teacher guides, video transcripts, and audiotapes. [1]

The use of authentic videos has, however, its drawbacks. Often they do not provide the best means of explaining complex concepts or practicing particular grammar or writing skills. It takes time for the teacher to preview and select authentic videos and then to prepare activities for learners. Since the language choice and the context of

3. Selecting Videos

Not every video is suitable to be used in ESL classrooms. Apart from the level of students and the skills the teacher wants to develop, there are some inherent criteria to be followed: inspiration/motivation/interest, content, and clarity of message, pacing, graphics, length of sequence, independence of sequence, availability and quality of related materials.

Authentic videos may contain language, or themes that are controversial, or even inappropriate in the adult ESL classroom. Preparing the learners to understand what they are going to watch makes the difference between time wasted and time well spent. It takes time and careful planning on the part of the teacher to prepare learners to watch and discuss these videos. However, selecting only films approved by the National Audiovisual Council of Romania or family programs is not always the best choice, as their content and language may be of little interest and relevance to adult learners. Teachers need to decide if the video meets the instructional

4. Using the Video

When planning a video lesson a teacher should have in mind the pre, while and post viewing activities so that to keep the students focused and to motivate them to get the most of the lesson. The pre-viewing activities are meant to get students familiar with the topic and to prepare them for what they are going to see. This is the time to pre-teach the new vocabulary if needed. Pre-viewing tasks could be brainstorming, quizzes, vocabulary matching or any other task that gives some background knowledge about what the students are going to watch. It may involve looking at still pictures from the video and predicting language and content to be covered. Finally, pre-viewing preparation means ensuring that an operating VCR and monitor is available and that the screen is large enough for all students to easily view the film. Fazy recommends using a 20-inch screen for a class of 12 to 15 learners. [3]

Moving on to the while viewing tasks, these should be done while the students are watching the videos or during

5. Types of Activities

When it comes to the different ways of using videos in class, there is a wide range of such activities to choose from. One suggestion might be to turn off the sound. The teacher presents the students a short extract (2 or 3 minutes is enough) with a lot going on, or where characters convey a lot of emotion in their expressions, without sound. Students can then do many things without having to worry about understanding dialogue. They can describe what happened using narrative tenses; describe the scene; anticipate dialogue or reactions; arrange the cut up dialogue which you have given them. Finally, the teacher plays the extract again with sound, and the students will be able to fit what they had seen.

Another idea would be to simply let just a part of the class watch a video, then have them describe to the others what they've seen and understood. This is how it's done. Half the class watches with no picture, then the other half with no sound (half the students gets out of the class in each case). In pairs they question each other to recreate the scene. Half the class has picture, the other half just sound. This can be done by sitting students in two rows, back to back, so that only one row can see the screen. The half who only had sound questions the other half.

authentic videos are not controlled, teachers will need to allot some time to explaining these. When a longer video is used, students tend to lose their attention, especially if the script is difficult. Students may lose interest in the plot completely as they are struggling to keep up with the language or even worse may misinterpret what it is being said. This is particularly applicable to lower level groups. Besides this, teachers have to pay attention to copyright regulations governing the use of broadcast programs off-air concerning how long the recording can be kept and how often it can be shown.

needs of the learners and if the context of certain language and cultural nuances, or distinction is worth investigating.

In what pacing is concerned, many authentic videos and even instructional videos are difficult for a non native speaker to follow. Thus, it is the teacher's responsibility to choose how much of the video, if any, should be watched and analysed. With second language learners, segments that are less than five minutes are often sufficient. A two- to three-minute segment can provide enough material for a one-hour lesson. What could be useful in decoding the message irrespective of the pace are the other components of a video itself, such as: graphics and charts. If they appear long enough on the screen, they can help students to fully comprehend the message conveyed. However, there still remains the problem of availability and quality of materials to be used. With authentic videos, transcripts may be available. If a movie has been adapted from a short story or novel, the text can be read before or after viewing the video. [2]

a short pause in the viewing. They should be short and simple. If there are too many tasks, or even worse, more difficult and confusing ones, the class can become boring. Students can lose interest and that's far off the aim set for this type of lesson. In other words students should be always kept active during the viewing so they don't switch off.

Finally, after the viewing, the teacher should review and clarify complex points, encourage discussion, and explain and assign follow-up activities whether they are included in the student texts and materials that accompany the instructional videos or they are developed for authentic videos. After watching an authentic video learners might be asked to get involved in a project related to the topic of the video. To give a few examples, a discussion could follow on naturally from a documentary, a role play or a 'what happens next?' could follow on from a soap opera and a character study or making your own comic strip could follow a cartoon.

Backward viewing is another option. Best suited for this kind of activity are short sequences with a lot of action. For example, a woman enters an apartment, picks up the telephone, speaks, looks terrified, runs out of her apartment and down the stairs, and runs off down the street. Movies are a good source for this sort of material. The teacher plays the sequence backwards to the students, then the students reconstruct the story in chronological order, using narrative tenses, or future tenses, or whatever the linguistic focus is. Finally, the teacher plays the sequence normally so students can compare it with their version. [4]

This next type of activity can be a lot of fun and it is best suited for young learners. The teacher chooses a scene and gets the students into groups according to how many characters there are. The teacher plays the scene without volume and gets each student to choose a character. Then she/he plays it again, stopping after each bit of speech and asks the students to invent the dialogue. It has to be noted that this activity involves going slowly and playing back many times to give the students time to think and write. When the students have the dialogue for the scene, the teacher plays again and gets each group to dub the scene with their dialogue. This activity can also be done with adverts.

6. Conclusion

Videos are an important resource for learners who want to improve their English language skills. They provide both the teacher and the learner with content, context, and language. Videos play an increased role in providing ESL instruction to students in the classroom as well as in self-study situations. However, regardless of the quality and

degree of difficulty of videos, whether they are used in a classroom, in distance learning, or in combination of the two settings, the teacher's guidance is crucial in facilitating this medium to improve adult English language learners' communication skills and knowledge. Thus, technology is making its way not only in our daily lives but also in classrooms.

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À LA RECHERCHE DE ... L'INTERCOMPRÉHENSION

Laura CIZER¹

Alina BARBU²

¹ Asist. univ. dr., Academia Navală Mircea cel Bătrân, Constanța

² Lect. univ. dr., Academia Navală Mircea cel Bătrân, Constanța

Abstract: *L'Union européenne est plurilingue, dans sa réalité quotidienne comme dans sa législation. Le recours à une seule langue de communication entre les différents peuples européens ferait peser un risque énorme sur la capacité de l'Europe à faire vivre ensemble des cultures et des langues diverses, sans parler de l'avantage économique et culturel qu'en retirerait le pays dont la langue serait devenue la langue intereuropéenne.*

Avec l'intercompréhension, les citoyens européens peuvent surmonter ce risque d'appauvrissement des échanges: elle installe entre eux un échange direct, plurilingue, respectueux de la forme de pensée de chaque interlocuteur. Elle est le signe d'une action concrète en faveur de la diversité culturelle et linguistique.

Les deux films français présentés dans notre ouvrage: „Les poupées russes” et „L'auberge espagnole” témoignent précisément de cette même habileté à communiquer en évitant le recours à une langue tierce entre deux personnes parlant des langues proches.

Key words: *intercompréhension, polyglotte, univers culturel, échanges linguistiques*

Depuis l'aube du langage, l'intercompréhension est une réalité quotidienne et une stratégie de communication pour des millions de gens. Pourtant, son potentiel reste encore largement inexploité. En effet, une mise en oeuvre plus générale de l'intercompréhension est porteuse d'enjeux qui ne touchent pas qu'à la langue, mais aussi à la pédagogie et à la politique.

Voilà pourquoi notre article s'est proposé d'aborder la portée sociale, politique et économique de ce concept qu'est l'intercompréhension, notamment dans les contextes de la francophonie et de l'Europe, car „une Europe de polyglottes n'est pas une Europe de personnes qui parlent couramment beaucoup de langues, mais, dans la meilleure des hypothèses, de personnes qui peuvent se rencontrer en parlant chacune sa propre langue et en comprenant celle de l'autre, mais qui, ne sachant pourtant pas parler celle-ci de façon courante, en la comprenant, même péniblement, comprendraient le «génie», l'univers culturel que chacun exprime en parlant la langue de ses ancêtres et de sa tradition.” [1].

De même, l'intercompréhension entre langues apparentées est une pratique très ancienne, dont on trouve des témoignages tout au long de l'histoire des peuples: „l'intercompréhension entre langues voisines, c'est la capacité des locuteurs à comprendre, en s'appuyant sur les ressemblances avec leur propre langue maternelle, les personnes qui parlent ou écrivent une langue apparentée. [...] En effet, une mise en oeuvre plus générale de l'intercompréhension est porteuse d'enjeux qui ne touchent pas qu'à la langue, mais aussi à la pédagogie et à la politique” [2].

Dans cette méthode d'apprentissage des langues, l'effort de communication se concentre sur des compétences de réception de la langue étrangère (lire, écouter) et met entre parenthèses les compétences de production d'une langue étrangère (parler, écrire). En somme, on pourrait ainsi résumer l'intercompréhension entre langues: „Je comprends la langue des autres, sans être en mesure de la parler. C'est pourquoi, quand j'échange avec eux, je leur parle ma langue et je comprends la leur” [3].

Aujourd'hui sont proposées au public des méthodes pédagogiques qui lui permettront d'accéder rapidement à une compréhension de l'écrit de certaines

langues européennes, puis en partie à une compréhension orale de ces mêmes langues. Il s'agit d'abord d'acquérir des compétences de lecture et d'écoute dans les langues proches de la sienne.

L'intercompréhension est donc une méthode de communication qui illustre une approche nouvelle de la politique d'apprentissage des langues: elle permet d'éviter le recours à une langue tierce entre deux personnes parlant des langues proches. Dans le contexte européen, ceci est particulièrement important. Ainsi, la plus élémentaire propagande visant la mondialisation, le „nouvel homme”, les bourses universitaires Erasmus et des exemples d'intercompréhension on va rencontrer dans le film franco-ibérique de Cédric Klapisch - *L'auberge Espagnole*, 2002: „J'ai décidé, sur ce film, justement parce qu'il a beaucoup de correspondances avec ce qui se passe actuellement, de plutôt me taire sur le sujet. Cela étant, c'est presque gênant pour moi de voir à quel point il prend un autre sens, et d'une façon très positive, puisque que c'est l'histoire d'un Français qui apprend à être un étranger. Etre étranger cela arrive donc même à des français”[4].

Xavier, étudiant en sciences économiques, rêve d'être écrivain. Mais son destin semble être d'intégrer le ministère des Finances grâce à un ami de son père, qui lui conseille d'aller vivre une année en Espagne, afin d'acquérir une spécificité qui favorisera son embauche. Il décide donc de faire une année d'études à Barcelone grâce au programme Erasmus. Loin de sa copine Martine, il se retrouve à partager en colocation un appartement avec d'autres étudiants étrangers: la Belge Isabelle, l'Anglaise Wendy, l'Italien Alessandro, l'Espagnole Soledad, le Danois Lars et l'Allemand Tobias. Entre dépaysement, choc culturel, difficulté de la langue (les cours sont en catalan alors que les jeunes Français apprennent l'espagnol à l'école), il commence à s'intégrer en profitant de sa vie d'étudiant.

„Le message que j'ai essayé de faire passer avec 'L'Auberge espagnole', c'est que l'Europe politique se construit «à côté» de celle que bâtissent les dirigeants de chaque Etat membre. Les étudiants en Erasmus ont une façon à eux d'imaginer une nouvelle Europe...”[5]

Quatre ans après *L'Auberge espagnole*, *Les Poupées russes*: ça tombe sous le sens. D'un film à l'autre, la même adhésion à une Europe «inter-rail», de Barcelone à

l'Oural, la même Internationale du flirt, de Piccadilly Circus à Paris. Et après le binz communautaire d'une auberge espagnole, le désordre amoureux des poupées qui se multiplient, à la russe. Cédric Klapisch ne change pas non plus. Il retrouve l'élan intact de *L'Auberge espagnole*, sa meilleure veine, et réussit à faire de ces *Poupées russes* mieux qu'une suite, au strict sens commercial: une poursuite. Comme le titre l'indique, il y a donc plusieurs films dans ce film, et beaucoup de comédies en une. La version classique, jouant sur les situations, ne manque pas d'abattage, notamment avec le personnage d'Isabelle. La version plus

zinzin carbure aux gags inventifs, comme lorsque, derrière Xavier, qui baratine banquiers ou éditeurs, surgit le double de Xavier, en train de jouer du pipeau... Troisième piste, la folie poétique quand, après une nuit d'amour chevaleresque, Xavier retrouve sur le trottoir son scooter transformé en cheval héroïque. Cela nous mène, jamais droit, à la comédie sentimentale, effleurant, avec Martine, la mélancolie du temps qui passe sans qu'on trouve la raison ou la passion. A chaque fois, Klapisch croque la jeunesse, fait tinter l'ironie de la vie, qui est toujours à la fois perdue et retrouvée, désorientée et orientée. Comme le film.

Conclusion

Les deux films sont autant de métaphores de l'intercompréhension et de l'intentionnalité de la communication, traits caractéristiques de l'Europe polyglotte de nos jours. *L'auberge espagnole* s'est éloignée de son sens primaire d'auberge caractéristique de l'Espagne dans laquelle on pouvait autrefois apporter ce qu'on voulait manger; et est déjà devenue synonyme de „p. compar., endroit, création humaine dans laquelle on apporte, on met

ce qu'on veut y trouver, où l'on ne trouve que ce qu'on y apporte”, c'est une expression qu'on entend souvent surtout depuis la sortie de ce film. Aussi, *Les poupées russes*, figurines en bois vivement colorées, de forme semblable, s'emboîtant les unes dans les autres, nous rappellent la nature de ce concept qu'est l'intercompréhension et permettent de déterminer la prise de conscience des locuteurs, de même que leur disponibilité et besoin d'activer de telles compétences.

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PSYCHOLOGICAL RESEARCH RELATING TO VALUES

Carmen Luminița COJOCARU¹

¹ Ph.D. Senior Lecturer „Mircea cel Bătrân” Naval Academy

Abstract: *The study deals with some aspects of the concept of value, the methodological context of the investigation as well as two modalities of placing the (professional) values in a hierarchical order, that is the one achieved on the criterion of the mean score of preference/acceptance (of its descriptive information „offer”) and the other one achieved on the criterion of intradimensional correlativity (with its integrative information „offer”) and aiming at the personological profile.*

Keywords: *value concept, hierarchy of professional values, research*

1. The theoretical context – aspects of the concept of value

Most commonly, the value is perceived as a special distinctive quality or as an ensemble of such qualities destined to satisfy reasons and aims of human activity. The value has its origin in the knowledge relationship subject – „object”. In one way or another, the value presupposes an optimum degree of awareness of the term relationship „partner” and that is why we should say that it is a feature proper to the rational being, the only one of the above mentioned relation, and who is capable of assign it to the other one. We were saying that this discovery, or state-of-the-art, or human deed endorsed by the coefficient of exemplarity etc., seems to us as „detached” from its author/authors, but only to the extent to which we can notice that the latter/the latter ones can assign it to the „object”. Expressions like „the value of a technical device”, „the value of a plot” etc. Are issued in full awareness that in that object or „product” the axiological significance is inculcated by the creative effort of the author as representing the „materialisation” of an activity or assignment with a certain result..

From the „opposite” point of view, we have the philosophical perspective – the axiology of a special system of theoretical knowledge about the origin, essence, hierarchical order and the social functions of values. Our introduction does not claim questioning the problem at this level. We shall use the senses (meanings) of the concept in question from a „working” perspective used in psychological research. The above mentioned utility is imposed by the nature of personological research which aims at obtaining an individual or group personological profile within which a special place is reserved to internalised values and to their expressive-behavioural component.

Three senses (meanings) are important in this discussion (after ERSOC, symbole-sigle under which a group of socio-cognitive researchers from the Grenoble University II Social Psychology Laboratory identify themselves; see the article *Value* in the *Psychology Dictionary*, 2006, R. Doron and Françoise Parot). The first sense draws together the concept of *Value* with the one of *Valence*. For the individual, a certain state of nature, of objects implies in a real mode an objective quality through which they appear as stimuli capable of generating a significance, negative or positive, sometimes in direct accordance with the motivational charge of the cognitive relation individual – object. This means that whenever the individual feels a state of necessity (needs, wants, reason, ideal...) they should turn to the object which can bring in the expected satisfaction. This means that at three different levels of structuring the life experience, of social influence, the individual conscientiously acts by orientation towards an „object” due to an interior impulse, a *motive/reason*. The real axiological sense of the object – stimulus, as a result of *internalisation*, presents itself as a feature/characteristic of the system of reasons specific for each individual or group. But not so much as to have an equal number of reasons or motivations with all the individuals and existing situations. At the same time the value appears as resident in the object itself the effect of *sui generis* assignment by the subject. (P. Popescu-Neveanu, 1978, the term *value*).

The second sense of the concept of value involves the *social utility* associated to the individual conduct as well as to the group behaviour, case in which the focus is placed on the „evaluation practices the function of which is to trace social utilities...”. The third sense of the concept of value is placed in a broader „ideologic” plan, in which the value draws near the *aim* (knowledge/cognition, freedom/liberty, solidarity)

and it is applicable especially to groups, without excluding the individual and it, „leads to the accentuation of the significance of praxis or social practices” (for instance, *military values* in general, some of them having some branch specifications such as qualities pertaining almost exclusively to navy personnel).

A great number of authors make a confusion between the first two senses assimilating the motivational-affective aspects with the evaluative ones, state maintained, among other things, by the methods and procedures in use in the researches in this domain (see for example *the semantic differentiator* of Osgood). ERSOC, whose example we took in stating this point of view (see: Roland Doron and Francoise Parot, *Psychology Dictionary*, 2006, the term *value*) reveals the regrettable character of this circumstance since „the study of social cognition (the representation of social situations, the implicit theories of personality) systematically point out massive of evaluative nature the statute of which is not explained” (2006, p.812). We have retained the objective and subjective side of the value in general, as well as its social utility. In our research we will adopt the third sense, from the perspective of which we will make some statements:

➤ Not all the values from several questionnaires are purely professional, some of them being unconditionally psychological.

➤ We do not have, as it is in the domain of ethics or aesthetics, a theory of psychological values, but there is a matter of consensus the fact that the reasons, feelings, ideals, the fundamental concepts, aptitudes and especially attitudes - these constitutive units of the personological profile, be it individual or in group, have clearcut axiological features, unless they can be considered (*psychological values* proper).

We should also mention that empathy, subject and concept relatively known, can be defined from a triple perspective: as a generic personality feature, as a special

2. The methodological context of the research - Subjects and method

Value research has been of current interest for doctoral theses within the *Philosophy and Psychology Institute* of Romanian Academy, for the last decade, theses which have had amongst their main objectives the grasping of some relations or even of the „whole” portrait of personality of various subject categories, resorting to adequate experimental designs. At the same time, the teaching staff from the Bucharest University – Psychology Section have published their own research results, one of them being used for elaborating an interesting *Value Inventory* (Marius Gheorghe, 2003). About certain researches on the theme we shall make special statements with a view to place our own research with some modest personal contributions, within the broader experimental context. We will give prominence to those who resorted to the Super professional inventory as well and with whom I have been working for the present paper.

The analytical presentation of the results communicated by previous researches would be undoubtedly useful from rather another perspective than the one we are interested in along the lines of this study. Therefore, we will primarily deal with general descriptive aspects (primary analysis), and secondarily, with specific-differential aspects. As we have proceeded in the doctoral theses, we will reserve for the primary analysis, with its corollary – the

aptitude and as *sui generis attitude* involved in human knowledge and interaction, therefore, as psychological value.

As a result, we find that all three senses of the concept in question have a certain psychological meaning, with a particular significance and specificity. For instance, „valence” as „the ability of an atom to combine with other atoms”, configures a property which leads to the principle of systemic organisation at different levels of psychological consistency; also, in ecology, the valence appears as „the possibility of a species to live in various environments”; or in Psychology („the valence of an object”, „attraction (*positive valence*) or repulsion (*negative valence*) which a subject experiences from their perspective” (*Dictionnaire de notre temps*, 1988, the term *valence*).

The value in its own right beyond the economic and socio-organisational sense of *utility* and/or pragmatic end, is a personality feature which envisage a set of qualities of the subject, justifying for the social esteem received, for the recognition granted and which, unconditionally involves *the self-appraisal awareness* – defining coordinate of great personalities. The judgements issued by personalities superiorly „crystalised”, (*value judgements*), as well as the judgements issued by the society on the representative personalities (*judgements of reality*) are *assertions* „which imply an *appraisal* (presupposing the undoubted competence a those authorised upon the evaluation capacities), upon what is stated as a „fact”, leads us to the most meaningful sense of value, namely the „ideal principle to which commonly refer the members of a community in order to found their judgements, and guide their conducts” (*Dictionnaire de notre temps*, 1988, the term *value*).

Such being the understanding of the concept of *value* and awaiting for a possible theory of psychological values we have attempted an investigation on this theme having as subjects future (eminent) navy officers, including a sample of officer-instructors as a reference lot, a first and delineated psychological investigation in the domain.

intradimensional corralivity of values, a more consistent part (in order to be able to actively engage in the present research domain) and we will proceed selectively in the case of „secondary” analysis – value intercorralivity and data interpretation of the most significant found in the factorial solutions (in order to distinguish the particular criteria within which certain final results can be ascribed to the personological profile of certain professional categories, in our case the profile of the navy officer). For more operativity, we shall mention/refer to especially five researches in the field from which we derived mainly data which respond to two analysis procedures: setting up of some first hierarchical order of the professional values under research, according to the value of mean score per lot, and to each top value-variable, and a secondary hierarchy, according to the „vocation” of the top value, in order to realise interactionist connexions (intra- and intercorrelations) within the area which comprises the 15 values of the *Super Inventory*. Therefore, we will resort to not only two modalities or forms of analysis, but also to (if not in the first place) two most assuredly levels of value interrelation, the former referring to the description and classification of values „on the surface”, the latter referring to the systemic interrelations of values „vertically” as indicators personological profile consistency.

The fundamental data selected from other researches are introduced in table number 1, with its two sections (A and B) modalities/levels of examination.

Table no. 1

A. Top and “low” values

| Authors | Subjects | Values | | | | | | | | | |
|-----------------------|---------------------|--------|----|----|----|----|-------|----|----|----|----|
| | | Top | | | | | „low” | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 11 | 12 | 13 | 14 | 15 |
| Buruian Rodica, 2000 | Pupils | MV | AE | AF | SP | RC | RS | CO | VA | CR | ES |
| | Students | MV | AF | RS | IN | RP | PR | ES | CO | VA | CR |
| | Counsellors | MV | AF | RS | AL | SI | RC | CR | VA | ES | CO |
| Sima Francisca, 2003 | Academy graduates | MV | AF | AE | RS | RP | CR | PR | CO | VA | ES |
| | HR Officers | AF | MV | RS | RP | AE | PR | CR | CO | VA | ES |
| | Military leaders | AF | MV | RS | RP | AE | CR | SP | AL | VA | ES |
| Popa V. Mircea, 2004 | Polit. Students | MV | AF | AE | RS | CR | RC | VA | PR | ES | CO |
| | Art Students | MV | CR | ES | AF | SI | RS | VA | PR | RC | CO |
| | Art experts | - | | | | | - | | | | |
| Popa C. Mihaela, 2006 | Journalism Students | AF | SP | VA | PR | MV | ES | SI | RS | CR | IN |
| | Journ. A/Video | AF | MV | AE | RP | RS | CO | RC | SP | VA | AR |
| | Journ. Press | MV | AE | RS | RP | IN | RC | ES | VA | AL | CO |
| Știr Cr. Corina, 2007 | Cooper. Students | MV | AE | RS | RP | CO | ES | SI | PR | VA | SP |
| | Compet. Students | AE | MV | RP | SP | IN | RS | AL | RC | VA | CO |

B. Value hierarchy (the criterion of intradimensional correlativity)

| | | | | | | | |
|-----------------------|-------------------|----|----|----|----|----|----------|
| Buruian Rodica, 2000 | Pupils | RP | IN | PR | CR | ES | m = 8,80 |
| | Students | AF | PR | IN | CR | RS | |
| | Counsellor | RS | CO | SI | PR | SP | |
| Sima Francisca, 2003 | Academy graduates | CR | VA | ES | MV | IN | m = 9,00 |
| | H R. Officers | IN | AL | RP | CO | RS | m = 9,00 |
| | Millitary leaders | AF | RC | IN | AL | RP | m = 9,40 |
| Popa V. Mircea, 2004 | Polit. Students | MV | AF | AE | RS | RP | m = 9,20 |
| | Art Students | MV | CR | ES | AF | SI | m = 9,80 |
| Popa C. Mihaela, 2006 | Journal Students | RS | CO | AF | RP | PR | m = 9,20 |
| | Journ. A / Video | AE | CO | AF | MV | VA | m = 9,60 |
| | Journ. Press | PR | ES | AE | SI | CR | m = 9,40 |
| Știr Cr. Corina, 2007 | Cooper. Students | RP | PR | CO | SI | RS | m = 9,60 |
| | Compet. Students | PR | MV | AE | SI | CR | m = 9,40 |

NOTE: Below is the table with the values researched, with their symbols

| | | |
|-------------------------------|---------------------------|-------------------------------|
| AL – Altruism | PR – Prestige | RS – Relation with superiors |
| ES – Aesthetic | CO – Command | RC – Relation with colleagues |
| SI – Intellectual stimulation | AE – Economic advantages | MV –Way of living |
| RP – Professional success | SP – Professional safety | VA – Variety |
| IN – Independence | AF – Physical environment | CR – Creativity |

As far as the hierarchy of values according to the criterion „the value of mean score”, regarding those values which are at the top, in the first two researches noted in Table no.1, three utilitarian values are present: *economic advantages*, *physical environment*, and *the way of living* (partially), less in the case of school counsellors (*economic advantages* absent), as it was found by Rodica Buruian (2000, p.108-110) and by Francesca Sima (2003, p. 118-122) with three lots of military – Military Academy graduates, human resources officers and military leaders. The other two top values (in the case of the school counsellors-three) are common for five out of six samples, *the value of relation with the superiors*, whilst the fifth top value, *professional success*, is common for both lots of students and for the military leaders lot as well. In the case of other three lots we find one value each characteristic for pupils – *professional safety*, for

psychology/pedagogy students –*independence*, and for counsellors – *altruism*.

Two observations seem to utterly impose: the one is related to the situation of the three top pragmatic values in a period still close to the changing of the social and political regim in the country, opportunity for releasing the old inhibitions concerning the free assertion of a new conception regarding individual property and way of life; the other observation is that at the top there are, for almost all the lots, values perfectly motivated, by the suggestion they give as a fact specific for profession: *relation with superiors* (especially with the military), *altruism* (with counsellors), *professional safety* (with pupils), *professional success* (with the military and the students).

In the case of the other works, elaborated later, with their sublots of investigation, one of the utilitarian values

is constantly” left out” (either *the economic advantages*, most frequently, or *the physical environment*), remaining almost permanently and with all the lots only the desired *way of life* – very likely a more profound aspiration towards liberty, dignity etc. For a change, there are recorded top values specific for professions, therefore for the domain of activity of the subjects like: *creativity* for the politechnic students, *aesthetic values* for the art students (Valeriu – Mircea Popa, 2004, p.98-101), *variety of conditions*, *the prestige* and *independence* for the journalism students (Camelia – Mihaela Popa, 2006, p.124-130), *professional success*, *command* and *independence* for the students in cooperation or competition conditions (Cristina – Corina Știr, 2007, p. 150-164).

The differences occurred in time, in the top values intensely uttered/assumed by various subjects seem to impose the idea that preparing for profession and doing a profession with real efficiency are associated with the internalization of a fundamental value, including the specific ones which can occur in assured components of some possible personological profiles which include attitudes-essential and specific values. More profound observations and interpretations can be revealed from the analysis of the hierarchies of the same values, but this time from the perspective of the „connexionist valences” criterion (intradimensional correlations) of these (see the second part of Table no.1). We assume/presume that the „new” hierarchies which can account for the consistency of the „system” of values can reach significant configurations different from those based on the value of mean scores. We, therefore, observe, that in almost all the cases, *creativity* (Rodica Buruian, 2006, for the cases of pupils and students; Francisca Sima, 2003, for the case of Military Academy graduates; Valeriu-Mircea Popa, 2006, for the case of written media; finally, Cristina-Corina Știr, 2007, for the students engaged in competitive activities). Another value absent from the top based on the value of mean score, which frequently appears in the top based on the disponibility of value intercorrelativity, is *command* (Rodica Buruian, 2000, for counsellors; Francisca Sima, 2003, for „Human Resources” officers; Camelia-Mihaela Popa, 2006, for the case of journalism and audio-video journalist students; finally, Cristina-Corina Știr, 2007, for students engaged in co-operation activities). Other values present accidentally in the

first modality/level of analysis appear with high frequency in the top based on the intradimensional correlativity criterion, such as *prestige* (Rodica Buruian, 2000, for all the experimental lots); *altruism* (Francisca Sima, 2003, for the case of military leaders and „Human Resources” officers).

Referring, as it is but becoming, to the intercorrelativity proportions of values, we opted for a number of correlations significantly equal with at least seven, in order to rank one value or another in the top. In this selection it has been operated on the total number of possible proportions of significant correlations for each value, so that, according to the mean proportions noted in Table no.1, sequence B, we find that the „top” samples which present the highest percentages of significant intercorrelations are, in decreasing order: the art students with 9,80%, school counsellors, the audio-video journalists and the students engaged in co-operation activities with 9,60% each. The lowest intercorrelation proportions of values are registered by pupils and Military Academy graduates (9,00% and 8,80% respectively). Thus, our supposition regarding the adoption of the modality/level of analysis of data on the criterion of proportion of significant intercorrelation as having the „vocation” of revealing some aspects of enhanced consistency of the personologic profile, seems to be sufficiently validated by the results of other researches. As we are going to see further on, it will be necessary for us to resort to another criterion, namely, the (high) level of general intelligence abilities and of the emotional intelligence as a *sine-qua-non* condition of consistency or crystalisation of the personological profile.

As far as the insertion of the top values in the verisimilar factorial configuration, essential aspect of results integration, which will be published independently, we can anticipate that, in a plurality of cases, with certain lots of investigation, a consistent set of fundamental values, will constitute in (axiologic) factors together with others of cognitive (intelligence) or personological nature.

In the area of psychological researches centred on values we mention as having for the time being only a methodological meaning the experiment in „terminus” stage of a value inventory – „IVL-91”, owed to Marius Gheorghe (2003) and a particular way of investigating the values in relation to engagement and development in career, owed to Valeria Negovan (2004).

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INTERCOMPRÉHENSION EN LANGUES ROMANES ET ACQUISITION DE COMPÉTENCES PLURILINGUES

Elena COMES¹

Marinela VRAMULET²

¹ professeur universitaire doctor, Universitatea Ovidius Constanta

² lector universitaire doctor, Universitatea Ovidius Constanta

Résumé: La présente contribution rend compte d'une expérience d'enseignement-apprentissage dans le domaine de l'intercompréhension en langues romanes réalisée dans l'Université Ovidius de Constanta dans le cadre d'un master proposé dans la Faculté des Lettres à partir de 2007, intitulé FLE et plurilinguisme dans l'espace européen. Il s'agit d'une formation universitaire dans le domaine du plurilinguisme par l'introduction de disciplines spécifiques pour ce domaine, telles, d'une part, les cours d'initiation à l'intercompréhension en langues romanes en tant que méthode d'acquisition d'une compétence plurilingue et, d'autre part, les ateliers d'apprentissage par intercompréhension, en vue de l'acquisition de compétences partielles, réceptives, de deux langues romanes inconnues aux candidats.

Ce master s'adresse en particulier à des étudiants ayant une licence en langues romanes et ouverts, par là, vers le plurilinguisme sur le terrain des langues romanes.

Mots clés: politiques linguistiques européennes, didactique des langues, master de plurilinguisme, inter-compréhension en langues romanes, formation de formateurs plurilingues.

1. Introduction

La présente contribution rend compte d'une expérience d'enseignement-apprentissage dans le domaine de l'intercompréhension en langues romanes réalisée dans l'Université Ovidius de Constanta dans le cadre du master FLE et plurilinguisme dans l'espace européen, mis en place à partir de 2007 dans le Département de Langues Romanes de la Faculté des Lettres. Il s'agit d'un essai d'initier des études de plurilinguisme à l'université par l'introduction, d'une part, d'un cours magistral d'intercompréhension en langues romanes pour des étudiants ayant une licence en deux langues romanes (français – comme première langue et italien, espagnol ou portugais – comme deuxième langue) et

ouverts, par là, comme trilingues (avec le roumain, langue maternelle) vers le plurilinguisme sur le terrain des langues romanes et, d'autre part, des ateliers d'apprentissage par intercompréhension de deux autres langues romanes.

L'objectif poursuivi par ces études dans notre Faculté des Lettres est l'acquisition par les candidats en master de compétences théoriques d'intercompréhension en langues apparentées et de compétences pratiques plurilingues, nécessaires, dans la perspective des nouvelles politiques linguistiques européennes, tant dans le domaine de la didactique des langues que dans le domaine des traductions et de l'interprétariat.

2. Plurilinguisme et intercompréhension

Notre entreprise s'inscrit dans l'orientation actuelle des politiques linguistiques européennes promues par l'Union Européenne et le Conseil de l'Europe, fondée sur la réalité de la diversité des ethnies de notre continent, orientation qui vise la création d'une nouvelle mentalité de la citoyenneté européenne, bâtie sur «la volonté de partager des valeurs communes et un destin collectif» qui implique «la participation des citoyens à l'élaboration des politiques européennes» grâce à leur «compétence plurilingue, c'est-à-dire la capacité d'intégrer de manière efficace et appropriée avec les autres citoyens d'Europe» [Charte Européenne du plurilinguisme, 2005, p.61].

La Charte Européenne du plurilinguisme, adoptée lors des Premières Assises européennes du plurilinguisme, qui ont eu lieu à Paris les 24 et 25 novembre 2005, souligne le rôle du plurilinguisme dans les relations internationales, en tant que réponse «au choc des civilisations et aux diverses formes d'hégémonie politique, culturelle et économique»:

«Le plurilinguisme change la perception et la construction des relations internationales. Parce qu'il porte en lui des valeurs d'ouverture à l'autre, il substitue l'esprit de dialogue et de construction d'un avenir commun à la psychologie de l'affrontement et du choc des intérêts.

Une langue unique comme langue de communication internationale n'est en aucune manière une garantie de dialogue et de paix. Elle est au contraire l'expression d'une domination» [Charte Européenne du plurilinguisme, 2005, p.6]

Cette politique favorable au plurilinguisme européen entraîne une politique éducative plurilingue, qui est promue actuellement par les organismes européens conçus dans ce but dans le cadre du Conseil de l'Europe, à savoir son Conseil de Coopération culturelle, dans le cadre duquel fonctionne le Comité de l'Education, qui a mis en place, à partir de la Conférence de Strasbourg de 1997, le Projet: Apprentissage des langues et citoyenneté européenne. Dans le cadre de ce projet, on a mobilisé les efforts de nombreux spécialistes européens en vue de la réalisation d'un document essentiel pour l'apprentissage, l'enseignement et l'évaluation des langues: Un cadre européen commun de référence pour les langues.

Apprendre – Enseigner – Evaluer, paru en 2000, qui est considéré comme le premier outil de politique linguistique véritablement transversal à toutes les langues vivantes.

Dans ce Cadre européen commun de référence pour les langues qui propose une méthodologie commune pour l'enseignement/apprentissage des langues, une terminologie commune pour ce domaine et une échelle commune des niveaux de compétence en langue, la promotion du plurilinguisme et de la politique éducative plurilingue est affirmée dès le premier chapitre. Cette politique, qui repose sur la diversité linguistique, s'appuie sur l'approche plurilingue de l'expérience langagière individuelle et se propose comme objectif la construction d'une véritable compétence plurilingue et pluriculturelle chez les citoyens européens, définie comme:

«la compétence à communiquer langagièrement et à interagir culturellement d'un acteur social qui possède, à des degrés divers, la maîtrise de plusieurs langues et l'expérience de plusieurs cultures. On considérera qu'il n'y a pas là la superposition ou juxtaposition de compétences distinctes, mais bien l'existence d'une compétence complexe, voire composite, dans laquelle l'acteur peut puiser.» [Cadre européen commun de référence pour les langues, p. 129]

Cette éducation plurilingue doit se faire dans le cadre des divers systèmes éducatifs européens, animés par la volonté de créer cette citoyenneté européenne active promue par la Charte Européenne du plurilinguisme. La première mission de l'Ecole serait donc l'apprentissage de la ou des langues nationales, base de tous les apprentissages et fondement de la cohésion sociale. En même temps, l'accès à l'acquisition d'autres langues doit être assurée par l'Ecole en vue de la formation des apprenants comme citoyens européens, en vue des échanges et de l'interaction avec les autres citoyens européens et du monde, dans la perspective d'une meilleure connaissance du monde:

«Le système éducatif doit offrir le choix d'une éducation plurilingue dès le plus jeune âge et développer les compétences d'apprentissage autonome nécessaires pour apprendre de nouvelles langues tout au long de la vie.» [Charte Européenne du plurilinguisme, 2005, p.8]

Dans la perspective du plurilinguisme, le but de l'enseignement/apprentissage des langues devrait ainsi être profondément modifié:

«Il ne s'agit plus simplement d'acquérir la "maîtrise" d'une, deux voire même trois langues, chacune de son côté, avec le "locuteur natif idéal" comme ultime modèle. Le but est de développer un répertoire langagier dans lequel toutes les capacités linguistiques trouvent leur place.» [Cadre européen commun de référence pour les langues, p. 11]

Cette éducation plurilingue a comme objectif non pas la formation de citoyens européens polyglottes, mais plurilingues, c'est-à-dire ayant des compétences linguistiques de différents niveaux dans plusieurs langues: des compétences de réception et d'expression en une ou deux langues étrangères, mais aussi des compétences partielles, seulement réceptives, pour d'autres langues, de sorte qu'ils puissent devenir aptes à communiquer dans plusieurs langues.

Comme le remarque Umberto Eco:

«Una Europa di poliglotti non è una Europa di persone che parlano correntemente molte lingue, ma nel migliore dei casi di persone che possono incontrarsi parlando ciascuno la propria lingua e intendendo quella dell'altro, che pure non saprebbero parlare in modo fluente, e intendendola, sia pure a fatica, intendessero il 'genio', l'universo culturale che ciascuno esprime parlando la lingua dei propri avi e della propria tradizione.» [U. Eco, *La ricerca della lingua perfetta*, 1993]

Cette compétence plurilingue suppose la promotion d'une autre mentalité dans l'enseignement des langues, d'autres principes et d'autres objectifs de la Didactique des langues, qui devrait pouvoir assurer la formation de formateurs plurilingues ainsi que l'introduction d'une nouvelle terminologie qui reflète une nouvelle réalité dans l'approche des langues étrangères telle:

- l'idée de l'étude *décloisonnée des langues* - qui implique des techniques d'apprentissage fondées sur la mise en commun des compétences linguistiques concernant deux ou plusieurs langues, dans le cadre d'une «compétence plurilingue et pluriculturelle qui englobe l'ensemble du répertoire langagier à disposition» [Cadre..., p. 129] et non pas par l'apprentissage des langues «chacune de son côté», en tant que «collection de compétences à communiquer distinctes et séparées suivant les langues» [Cadre..., p. 129]; dans l'étude *décloisonnée des langues*, des *savoir-apprendre transversaux et transférables* sont systématiquement mis à profit;

- l'idée de *compétence partielle et déséquilibrée dans l'acquisition des langues étrangères* - qu'il faut nécessairement accepter dans la compétence plurilingue visée pour l'avenir et qui suppose des compétences inégalement maîtrisées dans les différentes langues: une maîtrise générale plus grande dans une langue que dans d'autres et donc un «profil de compétences différent dans une

3. Contenus d'enseignement du master de plurilinguisme

Le programme de ce master a été conçu de manière à mettre en place et à valoriser les compétences de diversité linguistique et culturelle romanophones de nos étudiants qui ont une licence en deux langues modernes: Français et Italien, Français et Espagnol, Français et Portugais, Français et Anglais

Les disciplines proposées visent, d'une part, le développement des connaissances multilingues et multiculturelles des étudiants et, d'autre part, leur spécialisation dans le domaine de la didactique du plurilinguisme et de l'intercompréhension en langues romanes. C'est ainsi que des disciplines proposées dans le master, telles: *Analyse du discours dans les sciences humaines*, *Interactions verbales et traduction*, *Argumentation et discours médiatique*, *Métaphore quotidienne et plurilinguisme* développent et enrichissent la formation linguistique et culturelle des étudiants en leur offrant une perspective comparative plus large sur les autres langues romanes, à partir de leur formation bilingue ou trilingue; d'autres disciplines telles: *Univers réel et univers fictionnel*, *L'espace poétique entre modernité et décadence*, *Du texte littéraire à l'image filmique* proposent une approche des littératures de langues romanes qui met à profit les

langue de ce qu'il peut être dans telle ou telle autre (par exemple: excellente maîtrise orale de deux langues, mais efficacité à l'écrit pour l'une d'entre elles seulement)» [Cadre..., p. 105].

Parmi les outils de la promotion du plurilinguisme, l'un des plus importants est, sans doute, **l'intercompréhension**, dans son sens didactique de technique d'acquisition d'une langue par la mobilisation de toutes les connaissances dans d'autres langues.

Il s'agit de techniques fondées sur la spécificité de l'intercompréhension comme moyen de communication, spécificité qui est décrite dans la définition très générale de ce concept donnée dans *Wikipédia*: «technique de communication qui consiste à parler dans sa langue maternelle avec un locuteur d'une autre langue. Ce dernier, sans pouvoir répondre dans la langue de l'autre, la comprend et répond dans sa langue» [Wikipédia]

Cette définition, plutôt générale, a été précisée dans l'expérimentation effective de cette technique, utilisée dans une didactique spécifique, et cette mise en pratique de l'intercompréhension en tant que stratégie de communication qui peut créer des compétences linguistiques plurilingues a conduit à une définition beaucoup plus nuancée:

«Par intercompréhension nous entendons (...) une stratégie de communication, qui met en jeu plusieurs langues apparentées, stratégie dans le cadre de laquelle les compétences linguistiques acquises dans une langue A sont exploitées pour élaborer des compétences de réception dans les langues B, C, D, etc. appartenant à la même famille linguistique que A.» [C. Degache, 2006, p.21]

Les préoccupations récentes dans le domaine de l'intercompréhension ont mené à la mise en place et au développement de divers programmes scientifiques d'intercompréhension conçus pour différentes familles de langues, dont nous mentionnons ceux consacrés au domaine qui nous intéresse directement, à savoir les langues romanes: les méthodes *EuRom4* et *Galatea*, la plateforme interactive *Galanet*, le didacticiel *Itinéraires romans* ou le manuel européen *Euromania*. C'est cette déjà riche expérience dans le domaine de l'intercompréhension en langues romanes qui a été mise à profit dans le master de plurilinguisme que nous avons initié dans l'Université *Ovidius* de Constanta.

Ce master, intitulé *FLE et plurilinguisme dans l'espace européen*, vise la formation plurilingue et pluriculturelle de jeunes professeurs de langues et leur sensibilisation aux nouvelles politiques européennes en faveur de la promotion du plurilinguisme de même qu'à l'ouverture vers une profession qui puisse proposer aux apprenants l'acquisition par intercompréhension, à différents degrés, de deux ou plusieurs langues apparentées.

connaissances des étudiants dans ce domaine, en vue d'une analyse comparative de l'univers littéraire actuel dans la romanophonie; ou bien, des disciplines à vocation culturelle transnationale telles: *Mythes et symboles dans la culture européenne*, *Herméneutique de l'image*, *Représentations nationales et transferts culturels*, *Dimensions interculturelles et didactique des langues*, *Cinéma et société* sont destinées à développer et élargir les connaissances des différentes cultures européennes des étudiants dans la perspective d'une approche transversale et interculturelle à vocation didactique.

Dans ce contexte, une place importante est accordée à la didactique du plurilinguisme dans le cadre des disciplines «*Plurilinguisme dans l'espace européen*»: 1 semestre, 28 heures, 5 crédits et «*Intercompréhension en langues romanes*»: 3 semestres – 1 semestre pour la présentation des concepts et méthodes de l'intercompréhension en langues apparentées (50 heures, 5 crédits) et 2 semestres pour des ateliers d'acquisition par intercompréhension des compétences de compréhension écrite et orale d'une quatrième/d'une cinquième langue romane: 100 heures (50 heures au I^{er} semestre, 5 crédits et 50 heures au II^e semestre, 5 crédits).

4. Intercompréhension en langues romanes

En ce qui concerne l'axe *Intercompréhension en langues romanes*, on a prévu dans le programme un cours

4.1 Le cours d'Intercompréhension en langues romanes présente l'intercompréhension comme principale méthode d'acquisition de compétences partielles dans plusieurs langues apparentées – avec application aux langues romanes – les étudiants en master étant initiés aux techniques spécifiques à travers les méthodes et didacticiels les plus connus dans le domaine de ces langues.

Il s'agit notamment de:

- la méthode *EuRom4* proposée par l'Université d'Aix-en-Provence en partenariat avec d'autres universités de pays romanophones (de Rome, de Lisbonne et de Salamanque), sous la direction de Claire Blanche Benveniste;
- la méthode *Galatea* proposée à l'Université de Grenoble en partenariat avec des universités de Madrid, Barcelone, Aveiro et Rome, sous la direction de Louise Dabène;
- la plateforme interactive en ligne *Galanet* initiée dans le cadre de la même équipe internationale de Grenoble, sous la direction de Christian Degache;
- le didacticiel en ligne pour de petits élèves *Itinéraires romans*, initié par l'Institut des Sciences de l'Éducation de l'Université Autonome de Barcelone, sous l'égide de l'Union Latine, dans le cadre de ses activités de promotion et d'enseignement des langues;
- la méthode *Euromania*, proposée par l'IUFM de Midi-Pyrénées Toulouse, sous la direction de Pierre Escudé, intitulée «méthode d'apprentissage disciplinaire en intercompréhension des langues romanes en fin d'école primaire», dont le manuel commence à être introduit dans le système d'enseignement de plusieurs pays de langues romanes.

Ces méthodes sont présentées dans notre cours d'*Intercompréhension en langues romanes* du point de vue de leurs objectifs, leurs publics, leurs principes linguistiques et didactiques. Elles sont surtout analysées avec les étudiants en tant que stratégies didactiques spécifiques qui offrent des solutions diversifiées dans l'acquisition par intercompréhension du plurilinguisme en langues romanes. Les débats dans le cadre des cours interactifs que nous proposons visent la familiarisation de nos étudiants avec ces méthodes en vue d'une possible application dans leur activité didactique en tant que jeunes enseignants de langues. L'évaluation de leur activité dans ce domaine est faite à partir d'un projet propre qu'ils proposent à la fin du semestre et qui concerne l'application des techniques d'intercompréhension dans l'enseignement/apprentissage des langues romanes qu'ils maîtrisent.

Nous avons choisi cette manière de travailler parce que chacune de ces méthodes contribue à sa manière à un apprentissage efficace pour nos étudiants dans le domaine de l'enseignement/apprentissage du plurilinguisme par intercompréhension :

- avec *EuRom4*, ils acquièrent des stratégies de lecture par l'approche collective de textes en langues apparentées (français, italien, espagnol, portugais) et les techniques

4.2 Les ateliers d'intercompréhension

Les compétences acquises par les étudiants grâce à l'analyse de ces méthodes fondées sur l'intercompréhension sont mises en œuvre et valorisées dans le cadre des ateliers d'intercompréhension, prévus pour l'élargissement des compétences romanophones des futurs enseignants plurilingues: il s'agit notamment de faire apprendre aux étudiants deux autres langues romanes en appliquant les techniques de l'intercompréhension en vue de l'acquisition de compétences partielles dans des langues romanes qu'ils ne connaissent pas. Il s'agit uniquement de compétences réceptives: de l'acquisition de la compétence de *compréhension écrite* de textes non littéraires d'actualité dans l'espace européen et de l'acquisition de la compétence de *compréhension orale* d'un discours de langue courante.

En nous fondant sur le profil langagier de nos étudiants, qui connaissent au moins deux langues romanes:

magistral d'initiation à l'intercompréhension (un semestre) et deux ateliers de pratique de l'intercompréhension (deux semestres).

appropriées de compréhension globale de ces textes par l'exploitation des zones transparentes et par l'usage des inférences linguistiques ;

- avec la méthode *Galatea*, ils se familiarisent avec des techniques de travail individuel sur des cédéroms conçus pour francophones en vue de l'entraînement à la compréhension d'autres langues romanes (espagnol, italien, portugais) et sur des cédéroms conçus pour hispanophones, italophones et lusophones en vue de l'entraînement à la compréhension du français;
- avec la plateforme interactive de formation à distance sur Internet, *Galanet*, nos étudiants apprennent à passer de l'approche par intercompréhension des textes écrits à l'utilisation effective de plusieurs langues apparentées dans la communication: grâce à l'étude des échanges qui se déroulent sur cette plateforme, dans le cadre de sessions thématiques d'intercompréhension organisées entre des groupes de participants de différentes universités partenaires, nos étudiants ont pu analyser ces sessions interactives, dans leurs différentes étapes, depuis le choix du thème des discussions dans le forum et dans des chats jusqu'à l'élaboration de leur projet commun: la publication d'un dossier de presse qui réunit les synthèses des débats antérieurs sur le thème choisi ;
- avec le didacticiel en ligne *Itinéraires romans*, nos étudiants ont appris à appliquer les techniques d'intercompréhension dans l'enseignement/apprentissage plurilingue qui vise les petits élèves (de 9 à 13 ans), à travers des activités ludiques spécifiques pour cet âge, développées en marge de textes plurilingues de type récit, conte, petite histoire amusante; les modules du didacticiel sont conçus de manière à susciter l'intérêt et la curiosité des enfants et à les divertir par des exercices-jeux qui leur permettent de découvrir et de retenir les ressemblances entre plusieurs langues romanes (français, espagnol, italien, portugais, roumain) si bien que nos étudiants en master, qui sont en même temps professeurs débutants, ont pu efficacement appliquer les connaissances acquises par l'étude de ce didacticiel dans leurs activités didactiques en classe de langue
- avec le manuel de la méthode *Euromania*, les futurs enseignants plurilingues romanophones ont à leur disposition un outil didactique complexe qui propose un apprentissage disciplinaire plurilingue à intégrer dans les systèmes scolaires européens: c'est un modèle d'enseignement plurilingue des disciplines scolaires conçu pour de petits élèves (de 8 à 11 ans), par lequel on envisage l'acquisition des savoirs et des savoir-faire disciplinaires communs aux programmes des pays européens de langues romanes (la France, l'Espagne, l'Italie, le Portugal, la Roumanie) par la manipulation de l'ensemble des langues de cette famille; les vingt modules de la méthode visant des disciplines diverses, telles la biologie, la géométrie, la technologie, la géographie, l'histoire, etc., initient un apprentissage de ces disciplines en plusieurs langues romanes à la fois, par des techniques d'intercompréhension adaptées à ce niveau d'âge.

le roumain et le français, mais très souvent trois langues romanes, leur formation en licence étant déjà bilingue romanophone, on travaille dans les ateliers par sous-groupes en fonction de la troisième/quatrième langue romane à apprendre, en un premier semestre, et de la quatrième/cinquième langue romane à apprendre, en un deuxième semestre, les langues à choisir étant l'espagnol, l'italien et le portugais. On étudie par intercompréhension divers textes non littéraires d'actualité (principalement des textes de presse), en visant l'acquisition d'une compétence de compréhension écrite de niveau B2 du CECRL et d'une compétence de compréhension orale de niveau B1 du CERCL.

Dans ce qui suit, nous présenterons quelques aspects de notre expérience d'*enseignement par intercompréhension de l'italien* à un public de bilingues et trilingues romanophones dans le cadre d'un atelier

d'intercompréhension du master *FLE et plurilinguisme dans l'espace européen* pendant l'année universitaire 2008-2009.

Le point de départ dans l'acquisition de **la compétence de compréhension écrite** par intercompréhension est la sélection de textes en fonction de leurs dimensions et leur degré de difficulté: on choisit pour commencer des textes de journal de 15-20 lignes, avec des images qui facilitent la compréhension globale du texte ainsi que d'autres documents authentiques (affiches, publicités, la

Stratégies de lecture

Les techniques utilisées visent l'acquisition d'une compétence de lecture fondée sur une stratégie de compréhension globale du texte par la mobilisation de toutes les connaissances linguistiques des apprenants. Les étapes que nous proposons sont les suivantes:

- on commence par une lecture silencieuse individuelle du texte dans son entier en vue de sa compréhension globale – avec la suggestion d'exploiter en ce sens les zones transparentes du texte et on vérifie cette compréhension par des activités collectives avec tout le groupe d'apprenants: questions directes ou d'autre exercices (VRAI/FAUX, questions à réponses multiples, etc.);
- on invite les étudiants à faire la traduction du texte par des suppositions successives, sans leur fournir d'autres aides que des suggestions pour les voies à suivre, là où le texte n'est

Acquisition du vocabulaire

L'acquisition du vocabulaire se fait à travers les textes étudiés et en s'appuyant beaucoup sur la contrastivité: les mots à origine commune sont retenus facilement grâce à leur ressemblance avec ceux des autres langues romanes connues par les apprenants.

Par exemple, dans l'étude de l'italien, on met toujours en rapport les différents mots avec ceux qui sont identiques ou très semblables en roumain, en français et dans au moins une autre langue romane – pour laquelle les mots correspondants peuvent être fournis par les étudiants qui ont déjà étudié comme deuxième langue en licence l'espagnol ou le portugais.

A. Exploitation des transparences

Exemple: pour la compréhension du titre d'un article de la presse italienne proposé pour l'étude: *MEGLIO I LIBRI O I FILM TRATTI DAI LIBRI?* - on le met en rapport plutôt avec le français, le portugais et l'espagnol qu'avec le roumain, car dans notre langue il y a des dissemblances pour presque tous les mots de ce titre:

- Meglio = melhor (port.), mehor (esp.), mieux (fr.)
- (i) libri = (los) libros (esp.), (les) livres (fr.), os livros (port)
- (i) film = (les) films, (os) filmes (port), filme (roum.)
- tratti = tratos (port), tractos (esp.)

Un autre exemple d'exploitation des transparences: le début d'un texte littéraire (21 lignes) – «*Se la luna mi porta fortuna*» di Achille Campanile:

“*Una sera mi trovo in viaggio in una città straniera e lontana*”

- Una sera = seara (roum.), soir (fr.)
- Viaggio = voyage (fr.), viagem (port), viaje (esp), voiaj (roum.)
- Città = cidade (port.), ciudad (esp.), citadin, -e (adj. fr.), citadin (adj. roum)
- Straniera = străin (roum.), extranjera (esp.)

| Italien | Français | Espagnol | Portugais | Roumain |
|-------------------|------------------|--------------------|---------------------|--------------------|
| Sin dalla nascita | Dès la naissance | Desde o nascimento | Desde el nacimiento | Încă de la naștere |
| schermo | écran | pantalla | ecrã. | ecran |
| camminano | vont | van | Andam | merg |
| legame | relation | relacion | relacionamento | legătură |

Un autre type d'exercice efficace dans les cours d'intercompréhension est l'observation des structures des phrases dans les langues romanes à partir des structures de phrases en italien. Un exemple d'analyse effectuée:

“Quante volte vi è capitato di andare.....

une de certains journaux, couvertures de livres ou de revues, etc.), qui contiennent peu de texte et aussi des images, des symboles ou autres signes faciles à comprendre. On continue par de textes de plus en plus grands, en passant des faits divers des journaux, aux articles de petites dimensions traitant des problèmes d'actualité européens et même à des débats sur des questions proches des centres d'intérêt des étudiants.

pas assez transparent. On évite à tout prix la traduction mot à mot et on laisse de côté, en un premier temps, les mots et les structures «opaques» - c'est-à-dire ceux qui ne sont pas compris par suite des ressemblances entre les langues apprennées – et on fait ensemble, par la contribution de tout le groupe, une traduction globale et approximative; - l'étape suivante dans la compréhension du texte vise l'étude des zones opaques de chaque paragraphe et on suggère aux apprenants de faire les inférences linguistiques, textuelles et contextuelles, qui pourraient les aider dans la compréhension de chaque paragraphe dans son ensemble.

C'est ainsi que l'on fait, dans des phases successives, la traduction correcte du texte, sans chercher la version parfaite – ce n'en est pas notre but -, mais en acceptant toute variante proche, satisfaisante pour cette stratégie de lecture qui vise la *compréhension* du texte.

B. Exploitation des inférences:

Dans le cas des zones moins transparentes ou opaques des textes, les apprenants sont encouragés à faire appel à des **inférences linguistiques (B.1), textuelles (B.2) et contextuelles (B.3)**, qui pourraient les aider à découvrir le sens d'un paragraphe, comme par exemple dans le texte suivant:

“*Letteratura e cinema sono molto legati. Lo sono sin dalla nascita del grande schermo. Un legame molto stretto, il loro. // Simbiotico./Carta e pellicola che camminano mano nella mano per raccontare storie al mondo*”.

B.1. inférences linguistiques

- **nascita** → a naște (roum.), nacimiento (port), nacimiento (esp.)
- **legati** (mot transparent: roum. *legat*) par inférence linguistique aide à découvrir «un **legame**»

B.2. inférences textuelles

sin dalla nascita del grande schermo.

Les apprenants sont dirigés, à travers les questions, vers la découverte des termes tels que «sin», «schermo», etc. et encouragés à trouver les équivalences dans les autres langues romanes.

B.3. inférences contextuelles (+ textuelles)

Carta e pellicola che camminano mano nella mano...

Pour la découverte du sens du mot “carta”, les étudiants seront aidés aussi bien par le **texte** (le parallélisme «Letteratura e cinema» // Carta e pellicola) que par le **contexte** (Des questions telles que «Si «la pellicola» nous fait penser au monde du film/cinéma, «la carta» c'est quoi?»)

Les mots visés, on les met par la suite en rapport avec les équivalents des autres langues connues, en vue de souligner les différences, par comparaison au niveau de la famille de langues:

E vi **è mai capitato** di essere delusi da uno spettacolo cinematografico al punto tale da aver voglia di andar via prima della fine?

Magari vi è capitato, anche se poi siete rimasti perché avevate letto il libro”.

Exercices:

a) Observez les structures soulignées: Vi è capitato..... vi è mai capitato magari vi è capitato.

a) Y-a-il des correspondances dans la structure des phrases dans les langues romanes?

Acquisition des points de grammaire

Dans l'approche des points de grammaire, ce sont également les techniques contrastives qu'on applique, en identifiant avec les étudiants les éléments de base de la morphosyntaxe de l'italien et en les comparant à ceux qui leur correspondent dans les autres langues romanes connues par les étudiants
Éléments de morphologie étudiés:

- l'article défini et indéfini + l'article contracté: présentation et discussion du cadre général de l'utilisation de l'article (défini, indéfini et contracté) dans les langues

5. Conclusion

L'essai d'introduire l'intercompréhension comme méthode de travail avec des étudiants ayant une licence en langues romanes a constitué et constitue pour nous une expérience intéressante, qui donne satisfaction tant aux apprenants qu'aux enseignants par la valorisation complexe des connaissances acquises en vue de l'acquisition de nouvelles compétences.

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Sitographie:

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ECONOMIC ASPECTS OF INTERCOMPREHENSION

Sorinel COSMA¹

Simona COSMA²

¹ Associate Professor, PhD, “Ovidius” University Constanta, Romania,

² Teacher, “Mircea cel Batran” Naval Academy, Constanta, Romania

Abstract: *Intercomprehension offers significant advantages in terms of allocative efficiency and distributive fairness, making, in general terms, an attractive public policy. It is an approach which places an emphasis on diversity and takes multilingualism seriously. It can make multilingualism considerably cheaper and less cumbersome in the day-to-day operations of a linguistically diverse institution, while also meeting much higher standards of distributive fairness than the current tendency towards linguistic hegemony – English only – or the oligarchic alternative – prominent role of English, French, German.*

Until now, intercomprehension has been examined mostly from the perspective of applied linguistics or language dialects. Given its potential importance as a language policy instrument, a broad, interdisciplinary assessment of various language policy scenarios embodying intercomprehension appears very necessary.

Key words: *intercomprehension, economy*

Introduction

The essence of language is human activity – activity on the part of one individual to make himself understood by another, and activity on the part of that other to understand what was in the mind of the first. (Otto Jespersen, 1924)

Intercomprehension is a mode of communication where each one express himself in his own language and understand the language of the other. Intercomprehension wants to be a solution of international communication equitable, an alternative to the imposition of an language that favor one or several nations.

1. Market Failure and Language Policy

Just like the management of our natural environment, the management of our linguistic environment cannot be left over to the market, because of ‘market failure’. “Market failure” occurs when the free market does not ensure an adequate provision of a certain good or service (e.g.: public lighting, environmental quality). Public goods and services are characterized by non-rival consumption and the impossibility of exclusion. Linguistic diversity, just like environmental quality, is a public good where market failure is likely to occur. And just like the natural environment, the linguistic environment must be managed to ensure efficiency and to ensure fairness. Thus, coordination is necessary, and a “laissez-faire” approach will not do. Thus, the state must intervene, which economically justifies language policy. In the absence of “management” there is the risk of strong drift towards the dominance of one language – not efficient, and unfair. Language Policy is what a government does either officially through legislation, court decisions or policy to determine how languages are used, cultivate language skills needed to meet national priorities or to establish the rights of individuals or groups to use and maintain languages.

Many countries have a language policy designed to favor or discourage the use of a particular language or set of languages. Although nations historically have used language

2. Translation and Interpretation

Intercomprehension occurs between related languages, that is, within the same language group. It comes in two versions, one “strong”, encompassing all languages within a language group (romance languages), one “weak”, occurring within subgroups of a language group. Being achieved without major difficulties by most native speakers of any of the languages in a group, intercomprehension implies that there is no longer necessary to offer translation and interpretation services within a language group where the conditions for intercomprehension have been created. For instance, a document written in Swedish would no longer need to be translated into Danish, or a speech in Spanish would no longer need to be interpreted into Italian.

A text originally written in German will have to be translated into other languages. But thanks to intercomprehension, when being translated into Swedish, it will cover the needs of Danish readers, or if the text is translated into Italian, it will not be translated into French, Portuguese, Spanish or Romanian.

The UE staff together with European MPs number almost 35,000 persons. Let us assume their average career length of 10 years. This means that on the average about 3500 people enter the system each year and just as many

3. Cost Estimates

The cost of teaching intercomprehension

It depends on the inter-linguistic distance between a person’s first language and the other languages in the same group in which the person is expected to develop adequate receptive competence. It also depends on the number of languages in the group concerned. *The cost of achieving*

Recent academic research, undertaken under the aegis of the European Union, made possible developing methods which quickly give access to understanding of several related languages. These methods make it possible to shorten time and effort necessary for the training of another language and this, in three manners:

- Teaching to read and understand other languages, not speak nor write them.
- Optimizing the multilingual training according to the relationship of the languages
- Coping with an imperfect but functional understanding.

policies most often to promote one official language at the expense of others, many countries now have policies designed to protect and promote regional and ethnic languages whose viability is threatened.

Language policy covers a wide range of interventions. One particular language planning strategy is intercomprehension – the use of receptive competences in foreign, yet usually related, languages, enabling participants in a multilingual exchange to speak their own language and still be understood by other participants who have acquired receptive skills in this language. It is a useful strategy to counter linguistic hegemony and foster multilingualism.

Intercomprehension offers significant advantages in terms of allocative efficiency and distributive fairness, making, in general terms, an attractive public policy. It is an approach which places an emphasis on diversity and takes multilingualism seriously. It can make multilingualism considerably cheaper and less cumbersome in the day-to-day operations of a linguistically diverse institution, while also meeting much higher standards of distributive fairness than the current tendency towards linguistic hegemony – English only – or the oligarchic alternative – prominent role of English, French, German.

Also, intercomprehension meets core human rights concerns, in that it treats speakers of all languages much more equally.

leave it. This implies that the number of people who would need to be trained for intercomprehension would be roughly 3,500 per year. The average per-person cost of imparting strictly receptive skills in related languages was estimated at 3000 Euros. This means a total expenditure of 10,5 millions Euros per year. According to current cost estimates, intercomprehension is expected to bring about a decrease in expenditure of about 2,606 million Euros a year. If, in the long run, 10,5 millions Euros give rise to savings of 2,606 million Euros per year, this amounts to a return on investment of almost 250%.

Casual communication across language boundaries has shown that all other things being equal, it is often easier to understand written materials than oral speech. The surrounding noise can hamper the foreign listener’s ability to differentiate similar phonemes. Different accents used by different speakers may also be a problem. By contrast, reading a text in a foreign language is often easier, the receptor having a larger degree of mastery over the conditions under which reading takes place. On the basis of such empirical estimation, it is possible that the potential of intercomprehension, while considerable for written texts, is more modest for oral communication.

satisfactory transfer in intercomprehension or the cost of ensuring successful communication

It depends on the context. For example, some kind of professional language assistance is needed to help readers or listeners make sense of odd sentences where the use of colloquialisms would reduce transparency.

The cost of all the translation and interpretation that would still be needed in this context

The total cost is not the simple product of the number of directions of translation and interpretation by an average “per-direction” cost, therefore linear. Fixed costs must not be

ignored. They refer to the capacity to guarantee that any direction of translation and interpretation is maintained.

Conclusions

Until now, intercomprehension has been examined mostly from the perspective of applied linguistics or language dialects. Given its potential importance as a language policy instrument, a broad, interdisciplinary assessment of various language policy scenarios embodying intercomprehension appears very necessary.

Intercomprehension offers, without any doubt, academic, political, and economic advantages. Still, it has its shortcomings - it is rather imperfect and so far little has been published on the topic. And there are many who wonder whether it is indeed the future or a simple means of manipulation.

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THE EVOLUTION OF ENGLISH LANGUAGE IN THE CONTEXT OF GLOBALIZATION

Alina DAVIES¹

Maria CIOCAN²

¹ prof.def., CPILS, Academia Navala Mircea cel Batran, Constanta

² prof. def. dr, CPILS, Academia Navala Mircea cel Batran, Constanta

Abstract: *The English language is currently accepted as the world's lingua franca, as it is widely used in international transactions, navigation, the military, education, a.s.o. This paper deals with the emergence of English as a global language, as a linguistic consequence of globalization. Thus, the audience is invited to consider first of all, the necessity of having a universal language in this highly interconnected world, then the circumstances that favoured the evolution of English to its current global status, and lastly, the impact of this universal language on the other languages of the world.*

Key words: *globalization, evolution of English language, universal language, lingua franca, global language*

Global culture is a hybrid culture, because through the intense interactions and exchanges between cultures, the link between culture and local territories disappears, and the uprooted cultural practices blend giving rise to hybrid forms of culture and language. This paper deals with the problem that can be considered central to the idea of global culture - the global language. Thus, eighteenth-century thinkers such as Kant, Voltaire, Leibniz, Benjamin Franklin, promote the idea of a common global society and culture, in which there is one political view, a single religion and a common language. The most enduring and most popular artificial language - Esperanto - was invented and promoted by Ludwik Zamenhof in 1887. The test of time shows that Esperanto does not survive as a lingua franca, but it is replaced by the most extensive natural languages, such as Mandarin, English, Spanish, Arabic and Hindu [1].

Out of these languages, English is the true lingua franca in the world as it is the language mostly used in international transactions, media, science, navigation etc. But what makes English a lingua franca? Crystal stated that “A language truly achieves global status, when it acquires a special role, which is recognized in every country”. This special role of the language has two aspects, as follows: a) the language in question is mother tongue in several countries, as it is the case with English (United Kingdom, United States, Ireland, Canada, Australia and New Zealand); this aspect is insufficient because Spanish is mother tongue of several countries, so we need the next condition b) to be recognized and used in other countries where there are few or no native speakers of the language in question. The English language fulfils this condition: on the one hand, it is official language in some countries (like India, Singapore, South Africa etc.), being used in administration, education and media, and on the other hand, it is studied as a foreign language by over one billion speakers according to 1997 statistics from the British Council [2]. In other words, English is spoken by three categories of people: those who speak it as their first language (L1), those who speak it as a second language (L2), as an alternative to their native language and the last category is the population that learn and speak it as a foreign language (EFL).

The use of a lingua franca became necessary because translation was not always a viable solution. During the twentieth century, because of the consequences of the Industrial Revolution and later of globalization, mankind has reached highly developed levels of communication. After

World War II international agencies and institutions, such as UN in 1945, UNESCO and UNICEF in 1946, World Health Organization in 1948, etc. were founded to help with the global reconstruction and governance of the world. Within these organisations meetings are held for all representatives of member countries and in order to communicate there is a need for a lingua franca. Crystal cites the UN and its subsidiary organizations that use English 85%, French 49%, and Arabic, Spanish and German at a rate of 10%. Also after the war, global financial organizations were founded for the same purposes of reconstruction, and Americans have played an important role in this respect, thus imposing their language through the transactions made. Regional or political multinational groups, such as the EU or the Commonwealth were formed, and in order to communicate easily they need a common language. In addition to these formal groups there are also the cases of linguistically mixed communities, such as the ones in Africa and India, which need a lingua franca for communication between ethnic groups. The build-up of international contacts is the result of technological development, both in communication and transport. The mobility of people, both physically and electronically, increasing considerably, the world has come to be perceived as a “global village” and the global village needs a global language. Once the countries’ barriers have been lifted, leaving them opened to the global forces of finance, commerce, science and culture, the influence of English has spread

However, we must ask ourselves why English and not another language is used by such a large number of speakers. There are several points of view regarding this matter. Some studies support a theory that is based on intrinsic characteristics of the language: simple and flexible grammar, the lack of endings and gender of nouns, the rich vocabulary with 80% of the lexicon originating in the languages that came into contact with English [3]. David Crystal, however, rejects these explanations for the popularity of English, arguing that other languages that have been universal at a certain time, such as Latin, French a.s.o., have a complex grammar and multiple declensions but the intrinsic characteristics have not stopped the language in question dominating other languages at that time. In Crystal's view, the power of the people who speak a particular language can determine that language to reach global status.

The status of English as the language of globalization today is primarily the result of two factors of

historical circumstance: the expansion of British colonial power and the economic development of the United States. Although Britain was the one who brought the English language to the threshold of global status, until the nineteenth century, the chances of this language becoming truly global relied heavily on the American economic power to re-launch it. Otherwise the English would have followed the fate of Latin and French, which rapidly decreased in popularity along with the decline of the empires that promoted them. As we have seen, history shows that a nation imposes its language through its military power, but it also maintains and extends it by its economic power. This has always happened, but in the nineteenth and twentieth centuries this process intensified greatly through globalization. Since the nineteenth century, the economic developments take place globally, and are supported by communication technologies such as the telegraph, the telephone, radio, television and the Internet. Competitiveness in industry and business has led to an explosion in marketing and international advertising. All these examples of progress and interconnectivity come from mainly British and American influences and places in the centre of attention the language which promotes them and makes them known across the world: this language has been and still is English which appears to have been "in the right place at the right time" [4] throughout history. These circumstances have secured its first place in the world.

To get a clearer picture of the geographical spread of English, but taking into account the historical context of these developments, the American linguist, Braj Kachru, suggests that we imagine it as three concentric circles. The inner circle includes countries where English is spoken as mother tongue, the outer circle includes countries colonized by Britain and the United States where English is spoken as a second language and plays an important historical and governmental role in multilingual settings like in India, Malawi and over 50 other territories, and the expanded circle refers to those nations that recognize the importance of English as a universal language, although not colonized by any country of the first circle.

Historically, English was the natural choice for the expression of economic and technological progress. This is because the 'inner circle' countries didn't have another language with which English had to compete, so there was not a linguistic identity crisis. Therefore neither threats nor conflicts arose from linguistic sources. At the end of the nineteenth century London, the capital of the British empire was the ultimate source of English culture. Consequently, London acted as a magnet for migration and the number of inhabitants almost doubled in the last 40 years of the nineteenth century. Since the twentieth century, however, the legacy of the "imperial principles" has resulted in the fact that native speakers of English are outnumbered by non-native speakers, such as Africans, Indians, Chinese, Malaysians, if we take into the discussion the 'outer circle' countries. In these countries, which are former British colonies, because English has been used alongside their local languages, hybrid and exotic forms of language emerged, such as various forms: of African English, Caribbean English, and Indian English.

This process of language hybridization in the former colonies had begun to grow once English was imposed on the locals under occupation. A variety of English, very popular among American native speakers, especially the young population is Black English (BE), which resulted from the slave trade. Although initially speaking this kind of hybrid

English was perceived as a lazy speech with bad grammar and poor pronunciation, today it is recognized as a variety of English, no better nor worse than English spoken by the Scots, Londoners or New Yorkers, for example. Following the merge between African and European culture, English vocabulary was enriched with expressions such as to bad-mouth, high five, and common words such as voodoo, banjo, banana, and more. But, beyond the influence of words and expressions of African culture, black culture has penetrated the European culture through rock'n'roll and its spirituality.

A comparison can be made between the emergence of these varieties of English with the spread and absorption of Latin in the post-Roman occupation territories. In the late '70s the chief editor of Oxford English Dictionary, Dr Robert Burchfield, made a series of predictions regarding the future of English. His thesis argues that as Latin was absorbed by local languages and fragmented into many different European languages (such as French, Italian and other Romance languages); once the Roman Empire crumbled, in the same way, in a few centuries global English will disintegrate in different languages. Only time will show whether Dr Robert Burchfield's predictions will come true or not, but today there is a variety of English, which offers perhaps the best example of the disintegration of English into national languages, unintelligible to native speakers of English. "Di kuk di tel me my faamin, bot it nat so" translates into English "The cook told me I was shamming sick, but it's not so" [5]. This hybrid language, also inherited from the generations of slaves, is Caribbean English and it represents an important model for further development of new varieties of English worldwide. The most representative variety of English within the Caribbean English language family is Jamaican English, which has the highest number of speakers in the Caribbean islands. Jamaicans choose to speak a variety of English, by mixing English with their specific phrases and cultural expressions in order to preserve their national identity. A visitor from United States or Britain would find that English is used at least two levels of language: one of Standard English usually encountered in newspapers and editorials, and a Jamaican one, specific to the spoken language. Similarly in India, where English was adopted as an official language along with Hindi, several levels of English are spoken: from the street varieties, spoken by the people less educated, to the educated, cultivated population who are using a standard form of Indian English.

Analysing the varieties of English we can conclude that they all share this stratification of the language: from street varieties to elevated forms closer to Standard English. The inclusion of expressions and words from local languages into English is a natural choice of the speakers when they communicate with members of the same community. Language is inseparable from the identity of a community, being the main vehicle of expression of the specificity of a particular ethnic group or nation. Historical circumstances, traditions, cultural heritage of an entire people or ethnic group emerge from words, idiomatic expressions and proverbs specific to the language of that people.

Although the above varieties of English are accepted, today's global English has only two voices: British and American, which are also its main promoters. Its universality is supported by numerous training programs in English, an entire international industry through numerous products, such as cassettes, CDs, books, traditional and online courses and so on, which bring large profits for the United States and Great Britain.

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CHILDREN'S GAMES OR RETURN TO THE CHILDHOOD OF MANKIND

Sanda-Ileana DRAGALINA¹

¹ Lector univ. Academia Navală „Mircea cel Bătrân”, Constanța, Romania

Résumé: *Dans les jeux des enfants, considérés aujourd'hui une manifestation naïve de la vitalité enfantine, résident les racines culturelles de l'humanité. Les spécialistes y reconnaissent les traces d'une existence vécue dans la sacralité du mythe, le Paradis spirituel de l'homme à l'âge ou les Dieux envahissaient la conscience humaine.*

Key words: *game, children, folklore, sacred, profane.*

In folklore studies, the „Kids` Folklore” chapter is a „must have” one, arousing the interest through the variety of the recorded breeds as well through the fact that it tries to catch the transformations they undergo.

While passing by groups of children who are playing, we will notice that words, as old as the world, in which the linguistic intervention is stacked upon archaic, prestigious meanings.

Incantations, spells, allegorical sayings, lullabies and even fairy tales are outspoken with joy, sincerity, and naivety without even realizing that at an interference point between mystery and revelation they ingeniously fill the most confusing gaps that knowledge has and that they serve as reference point in time and place.

Who else, besides scientists, knows that what we, today, call Kids` Folklore once belonged to grown-ups. They, for various reasons, started considering them immature and thus, abandoned them. So they found their way in the youngsters patrimony, ignoring thus, in time, the spiritual treasures they carry. Today, we find it hard to suspect that behind stories, which at first sight seem to tell the battle between good and evil lays hidden a philosophy of imagination in which symbols of myths and rites blend.

Would it be possible to rearrange this world on the fundamentals of the sacred; a practice that involves playing, for example, as well as its spiritual brother, the symbol?

Before belonging to a specific „social time”, don't these „crumbles” belong to the grown-ups` feast of the Great Mythic Time? Let us think back to the times in which the economic activities were interrupted by clearly defined moments in the church calendar, time in which privileged „interactions” with the sacred took place, moments centered on intense community life and the passing on of myths. Allowing access to the sacred means, first of all, making it accessible, namely elaborating a concrete representation of it. The sacred does not limit itself to the demeanor of the story, but it is lived on a „playful”, theatric level, in the words of J. Huizinga: „*the sacred action is dromenon, namely something doable; something that represents drama, an action, regardless of its nature (i.e. a show or a competition)*”.[16]

Surely, every society gives birth to unreligious art forms as well as to game related recreational activities; still, the world of profane games lacks no ritualistic origins and no symbolic motivations. Going back to the theses of J. Huizinga, theses about the game related fundamentals of culture, R. Caillois [7] notes how different games from different peoples` recreational patrimony have religious roots. Games involving a ball, for example, reference the agonistic rites which mimic the battles of gods; bullfighting comes from an old bull praise from Crete; the kite was, in China, an image of the soul and hopscotch symbolizes the maze of initiation, the plan of which is preserved in the one of the Christian Church.

Games allow the organizing of sequences of gestures chained and associated through symbolic motivations. The game is for the body what the symbol is for the spirit, and both are centered on the supernatural finalization of the exploration of invisible charges that things have. The practice of the sacred contains, besides the game, a ritual. This is because the sequence of the sacred actions is not spontaneous, improvised, it is dosed and follows a pattern: the story is what takes place within the initiation ritual, the passing ceremony from the global society to a secret one or from being regular member of the society to being a consecrated one (e.g. shaman or priest) and even the coming of age.

The different stages (moments) of the tale with the initiation script are used to objectify, socially speaking, the transformation of the being and to interiorize the access to new psychic depths through intense moments of high numinous tension. Faimoasa invocatie „*Melc, melc, codobelc / scoate coarne bourești...*” in care este vorba tot de trecerea de la potențialitate la act. Analyzing the spell, L. Blaga [5] notes its ambivalence, namely the simultaneous nexus of magic and poetry. The same can be said about posers and „tongue twisters”. The allegorical saying differentiates itself from the riddle by not asking a question which contains the answer. The allegorical saying is a latent perplexity which awaits its` solving. In „*Jocuri de copii*” (Children's Games) T. Pamfile records a saying which we find in „*Amintiri din Copilărie*” (Childhood memories) by Ion Creangă: „*Auraș, păcurăș, take the water out of my ears and I'll give you old money, ... etc.*” What is it that „*auraș, păcurăș*” enchants and disenchants? V.Lovinescu [19] would rather say it is about a spiritual ear than a physical one: „*the allegorical saying updates and restructures the interior hearing, where there is no more separation between subject and object, therefore the Verb is heard and said alone*”. The famous summoning „*Melc, melc, codobelc / scoate coarne bourești...*”.

The formula uttered by Nică in „*Amintiri*” of a sacred nature, is accompanied by gestures. Both the formula and the gestures are of a non-human nature, since Creangă sustains: „*that was the custom when bathing, since Adam-babadam*”, namely „*Adam, Adams` father*”, which is the equivalent of „*The Universal Man*”. As the line is at bathing, and the spell brings its caster to the surface of the primordial waters. In childhood we are stuck irremediably with the tongue twisters and in full linguistic and oneiric delirium, as their name suggests. The circumstances in which spells take place are significant, kids sit in a circle and one of them starts the incantation. With each Onomatopoeia, the child's finger points to someone in the circle. The one pointed to once with the last term, is eliminated from the circle. In other words, is eliminated form „*The Becoming*”, form the circle of dying and rebirth.

„*Uni/Doni/Trini/Pani/Rusca/Busca/Godi/Mani/Pisiric hi/Pichi!*” is an example of tongue twister which children often

use. The first four „words” are numbers that became onomatopoeia; the following four are incomprehensible but, isn't it said that a spell is more effective as it cannot be understood? „Pisirichi” clearly shows that it is about „bird's language”; in all traditions „bird's language” is the language of angels, a solar idiom. The „words” are spoken by the children, namely the last part of mankind in which the Paradise still lingers. In other words, the mystery does not present itself directly, in pure forms but indirectly, as a myth and a symbol. Sadly, man broke the bonds with the Heavens, living in the absence of transcendence. Also, the secret of „fairy-tale-ing” got lost as well, at the same time as those traditional sciences, cropped, at the origins, from a sacred code, a celestial one.

Regarding the mythical sensibility, it is considerably worn out. The myth itself becoming a „fable” an unlikely story. Its

isolated literary study „brings forth the wilting of the universe” [19]. To cut its stellar roots, means accepting it in substitute forms; or, as its roots being an epiphany „a disclosure through an enigma through which the dew of the Heavens convergently gathered at the bottom of a cup, representing the upper half of an hour glass, point from which it divergently distributed in the sub-lunar world” (V. Lovinescu)

The eternity value of the Romanian Villages' world lasts, according to Blaga; as a fall-back of a benefic prehistory in the bustle of history, to keep for us a perpetual childhood, nourished by living in the „mystery horizon” of mythical thinking, of magical thinking, because „the mode of existence on the sill of mystery” [5] is the condition without which the human being cannot be conceived in its wholeness.

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EVALUATION ANALYSIS OF WASTE COLLECTION AND STORAGE IN THE SOUTH-EAST DEVELOPING REGION OF ROMANIA

Georgeta DRAGOMIR¹

Ștefan DRAGOMIR²

Carmen-Marina DRAGOMIR³

¹ Prof.univ.dr., Universitatea “Danubius” Galați

² Prof.univ.dr., Universitatea “Dunărea de Jos” Galați

³ Masters Universitatea “Dunărea de Jos” Galați

Abstract: *Economical activity of collection and disposal of urban and rural waste in the south-east developed region, are organized differently depending on: the size of locality, the number of people served, equipment, property form, the area from which collection (urban or rural) and the disposal surface. This study presents a complete analysis on the waste collection and a comparing between divers types of disposal area.*

South-east developing Region is located in the south-eastern Romania, covering 35,762 km² or 15% of the total area of our country. The south-east region is the second largest between the eight developing region of Romania. The districts that are included in this development region are: Braila, Buzau, Constanta, Galati, Tulcea, Vrancea.

Key word: *Waste collection, transport system, disposal area, types of disposal.*

1 Introduction

The locality network of South-East Region was composed of 33 cities (of which there were 11 municipalities) and 1455 villages (organized in 339 communes). The largest city of the region is Constanta (309,965 inhabitants), followed by Galati and Braila (over 200,000 people), Buzau and Focsani (100,000 inhabitants). In 2005, the Region had a population of 2,850,318 inhabitants, representing 13.1% of the population, density of 79.7 inhabitants/ square km, is below the national average (90.91 inhabitants / square km). The highest density of population is in Galați County (139.5 place / square km), dominated by industrial and commercial centre with the same name, and the lowest in the county of

Tulcea (29.9 place / square km), where natural and economic conditions are less adequate. In this development region (Braila, Buzau, Constanta, Galati, Tulcea, Vrancea) the business of collection and transportation of municipal waste in are organized differently depending on: the size of locality, the number of people served, types of separate equipment and the depot zone.

The specificity of South - East developing Region is the disparity between the nodes of concentration of industrial and tertiary activities (Braila - Galati, Constanta - Navodari) important industrial points and county Buzau- Focsani, with specific tourist areas (coast and Danube Delta).

For the south-east developing region is characteristic discontinuity of industrial activities and an increased the trade, services, tourism and agriculture. This is because counties of Constanta and Galati are characterized by a higher rate of employment in industry and Buzau, Braila and Focsani.

Economically after Eurostat studies [10], made in 2007, Romania is situated on the penultimate place in the EU according to GDP per capital. For 2008, experts from Eurostat anticipate a GDP national average per capita of 5450 Euro. Under this level will find our south-east developing region with 4609.3 Euro.

2 Research on waste collection systems

For waste collection there are urban services that are employed by local city halls of Residence County. They made the collection and transport of waste in terms of the quantity produced of the area that serves. The table below

presents the statistical number of environment agencies and the people it serve [1]. Note that in the south-east region for Constanta and Galati is the highest number of environment agencies (Source: Local Administration).

Table no.1: Environment Agencies for 2008 year

| County | Number of environment agencies | Number of inhabitants | Percent from overall populations (%) |
|-----------|--------------------------------|-----------------------|--------------------------------------|
| BRĂILA | 3 | 233.556 | 62,82 |
| BUZĂU | 4 | 128.730 | 25,96 |
| CONSTANȚA | 11 | 504.573 | 70,68 |
| GALAȚI | 5 | 328.460 | 52,87 |
| TULCEA | 6 | 110.064 | 46,04 |
| RBDD | 1 | 3600 | 25,04 |
| VRANCEA | 10 | 97.891 | 25,29 |
| TOTAL | 40 | 1.406.874 | 49.5% |

Another analysis was effectuated to evaluate the number of people served by environment agencies in rural and urban. Table 2 presents the number of residents in rural and urban that receiving environment services.

Table no.2: Served population by Environment Agencies in 2008 year.

| | URBAN | | | RURAL | | | TOTAL on REGION | | |
|-----------|-----------|----------------------|--------------------|-------------------|------------------|--------------------|-------------------|---|--|
| | TOTAL | Number of inhabitant | Number of inhab. % | TOTAL Populatio n | Number of inhab. | Number of inhab. % | TOTAL Populatio n | TOTAL inhab. served by environment agency | TOTAL inhab. served by environ ment agency % |
| Region | 1.581.446 | 1.375.967 | 87.0 | 1.261.624 | 30.907 | 2.4 | 2.843.070 | 1.406.874 | 49.5 |
| Braila | 242.570 | 230.441 | 95.0 | 129.179 | 3.115 | 2.4 | 371.749 | 233.556 | 62.8 |
| Buzau | 205.285 | 125.237 | 61.0 | 290.593 | 3.493 | 1.2 | 495.878 | 128.730 | 26.0 |
| Constanta | 507.731 | 484.950 | 95.5 | 206.094 | 19.623 | 9.5 | 713.825 | 504.573 | 70.7 |
| Galati | 353.349 | 328.460 | 93.0 | 267.812 | 0 | 0.0 | 621.161 | 328.460 | 52.9 |
| Tulcea | 119.643 | 109.547 | 91.6 | 119.403 | 517 | 0.4 | 239.046 | 110.064 | 46.0 |
| RBDD | 4.418 | 3.600 | 81.5 | 9.955 | 0 | 0.0 | 14.373 | 3.600 | 25.0 |
| Vrancea | 148.450 | 93.732 | 63.1 | 238.588 | 4.159 | 1.7 | 387.038 | 97.891 | 25.3 |

The next step in the development of research performed was to measure and expressed in percent quantities, types of waste produced in the region of south-east [2, 3], in the period 2004 to 2008 (table no.3).

Table 3: The degrees of waste collection between 2004 to 2008 years.

| Indicators / year | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|------|------|------|------|------|
| House hold waste (%) | 91,2 | 86,2 | 84,3 | 83,6 | 82,3 |
| Municipally waste (%) | 0,4 | 0,5 | 0,5 | 1,3 | 1,6 |
| Number of inhabitant serves by environment agencies (%) | 45 | 46 | 47 | 47 | 48 |
| Quantity of waste collected (Kg/inh.year) | 209 | 235 | 236 | 228 | 235 |

If we take in account the ways of waste collecting, for that it was using garbage bin, containers and euro-container as it seen in the table no.4.

After the calculus result that the optimal frequency of collection is cca.3 days. Therefore, the euro-container and containers should be chosen so as to cover the volume of waste to be generated during this period.

It is estimated that the collected is doing every three days; the amount of waste generated will be approximately constant, like in table.

In the south-east region before the processing of waste paper, metal, plastics, for recycling, primarily these wastes are collected in authorized points, like in table no.4.

Than, the collected waste are separated from unauthorized collectors (private persons) or directly from people engaged in commercial activities. Waste separated is delivered by economic recovery.

Table 4: Waste collected (container, euro-container and garbage bin) 2008 year.

| Region/ County | Type of container | | | | Total volume (m ³) |
|-------------------|--|------------------------------------|---|-------|--------------------------------------|
| | Garbage bin (0,1-0,2 m ³) | Container (4-5 m ³) | Euro-container (1,1 m ³) | other | |
| Region South-East | 15.569 | 8.688 | 2.328 | 2.467 | 44.837 |
| Brăila | 1.199 | 1.939 | 170 | 1 | 9.057 |
| Buzău | 469 | 341 | 1.078 | - | 2.748 |
| Constanța | 9.399 | 5.563 | 43 | 1.422 | 28.055 |
| Galați | 801 | 167 | 452 | 7 | 1.351 |
| Tulcea | 3.549 | 129 | 485 | - | 1917 |
| RBDD | | | 100 | 5 | 106 |
| Vrancea | 152 | 549 | - | 1.032 | 3.520 |

Taking into account that a waste density is of 0.25 t/m³, the waste generated for three days is 44,804 m³ and on a week is 89,608 m³.

The next review of Waste Management Regional Plan will must to calculate the specific capacity of containers

3 Waste treatment

Today, at level Region south-east there is a sorting station located in Constanta County. This sorting station is established in 2005 and her name is SC MM RECYCLING LLC and is used for treatment of solid urban waste. The capacity of sorting is of 9 tons / hour for solid waste and too has a recovery capacity of 450 tons / hour for PET. This firm has possibility by sorting waste paper, plastics, iron and aluminium. In Galati County is beginning in 2008 the construction of a sorting plant and a composting plant that serve too and Braila county. At level of Region is necessary

3.1 Waste treatment into the disposal

In Region 2 South, in Constanta county there is a cement factory Lafarge Medgidia, which is part of the Lafarge Group. The cement factory engaged in co-incineration plant using only the residues with high caloric value, such as the waste used oils, tires or plastic.

On local politics, waste management in South-East developing region has been drawn up in accordance with law and the provisions of GEO 78/2000 on waste regime, approved by Law 426/2001 and amended by EGO 61/2006 [5]. According to GD 349/2005 [6] on waste disposal, which incorporates Directive 99/31/EC [7], landfills are classified as:- for no hazardous waste landfills (type a); -for hazardous waste landfills (type b); - for inert waste landfills (type c).

Regarding to the Directive 99/31/EC, on the disposal of waste were made following steps: - have been campaigns of

(a day or week) and that is made for cover the population needs. Under Romanian law containers of waste must be collected each day in summer and during the winter every two or three days.

to build a station plant for the mechanical and biological treatment of waste.

Recovery of waste is done in general for waste plastics, metals, paper and cardboard, tires, batteries, etc..

The companies that collect and treat waste recycled mills are equipped with the package, weighing equipment for processing waste mass plastics, electronic bascule bridge, crane, cutting kits, electric grinder.

The identification of the economic activity involved in collecting and/or recovery facilities and capabilities at their disposal.

public awareness regarding orders GD 349/2005 and 857/2004 and 1247/2005 MEWM - were taken to Meet the responsibilities of planning and authorization of government institutions - have been identified, inventoried and classified deposits existing municipal waste - and to making the planned closure of existing waste landfills and construction of municipal landfills in accordance November. In the South Region 2 storage is the main option for municipal waste disposal. Each urban village is at least a deposit for waste. In 2008 at level of South-East Region were 21 non-conformed municipal landfills.

In addition to deposits listed above, in Region 2, there are about 1049 stores non conformed, which are not in line with European standards and regulations. These are mostly wild warehouse operated by the community, especially located in rural areas. The closing date of all such deposits

will be non-compliant in 2009, according to GD no. 349/2005, Article 3, and paragraph 7 [6]. Before closing an audit is necessary environment to describe procedures to reduce

environmental impact. For both activities need funding. In the next table we show the type and the number of waste disposal – non conformed - who must be closed in 2009.

Table 5. Non conformed waste disposal that must be closed.

| County | Number | Type | Closed year |
|-------------------------|--------|------|-------------|
| Braila | 121 | b | 2009 |
| Buzau | 369 | b | 2009 |
| Constanta | 53 | b | 2009 |
| Galati | 196 | b | 2009 |
| Tulcea | 185 | b | 2009 |
| Vrancea | 170 | b | 2009 |
| Total Region south-east | 1094 | | |

The number of conformed waste disposal is nine at this time: 3 at Constanța, 2 at Galati, 1 at Braila, 1 at Buzau, 1 at Tulcea and 1 at Focsani.

In the county of Constanta are 3 organic deposits (located in areas Ovidiu, Costinesti and Albesti). The quantity of waste stored here is about 346,000 tons / year. Ecological Depot and industrial waste - Ovidiu administered SC TRACON SRL, serving 400,000 inhabitants (Constanța, Ovidiu, Lumina, Navodari). Of the projected 8 cells, 2 are closed, the third is in operation and the fourth is under construction. Ecological disposal and industrial waste - Costinesti is administered by SC Iridex GROUP IMPORT EXPORT SRL, serves 53,000 residents in Costinesti, Amzacea, Agigea, Cumpăna, Eforie, Techirghiol, Tuzla, Topraisar number they can add 70,000 - 100,000 tourists per

year. Organic waste depot - Mangalia (Albesti) located at a distance of approximately 500 m from Lake Mangalia is administered by SC ECO GOLD INVEST SA.

In the county of Galati new landfill Tirighina is an extension of the old warehouse and will be developed adjacent to existing uncontrolled landfill. New deposit of waste will have 4 cells with a total area of 18 ha. The first cell has a capacity of 920,000 m³ and a life expectancy is projected to be 4-6 years.

In the county of Tulcea (Vararie) and Vrancea (Haret) is provided for construction of new municipal landfills.

Table 6 presents the quantities of waste collected in the storage areas in the south-east development between 2004 until 2008.

Table 6: Evolution of waste quantity.

| Warehouse area / Quantities | An 2004 (t/a) | An 2005 (t/a) | An 2006 (t/a) | An 2007 (t/a) | Volume disposal on 2008 (m ³) |
|-----------------------------|---------------|---------------|---------------|---------------|---|
| Ianca | 5 | 6 | 7 | 7 | 35 |
| Faurei | 3 | 3 | 3 | 4 | 100 |
| Muceha | 72962 | 71964 | 55867 | 77204 | 460000 |
| Nehoiu/Buzău | 1047 | 1080 | 942 | 1269 | 11000 |
| Buzău/Buzău | 101285 | 112452 | 85035 | 45579 | 0 |
| Galbinaș | * | * | * | 10162 | 270000 |
| Rm. Sărat | 12265 | 16869 | 20676 | 10184 | 450500 |
| Ovidiu | 123645 | 160028 | 172117 | 182880 | 3900000 |
| Negru Vodă | 5900 | 6000 | 6100 | 6300 | 240000 |
| Eforie Sud | 13340 | 9184 | 9301 | 11123 | 20000 |
| Albești | 66601 | 94842 | 84700 | 67571 | 1200000 |
| Medgidia | 38806 | 41501 | 47433 | 43076 | 60000 |
| Hârșova | 9200 | 8000 | 8900 | 9000 | 80000 |
| Cernavodă | 7664 | 8767 | 9616 | 9245 | 275000 |
| Techirghiol | 7800 | 8650 | 7305 | 7300 | 20390 |
| Basarabi | 6500 | 8100 | 8100 | 9600 | 60000 |
| Tirighina | 147869 | 184682 | 199304 | 205059 | 665000 |
| Umbrărești/Moscu | 210 | 280 | 370 | 490 | 7700 |
| Băzanu/Berești-Est | 880 | 990 | 990 | 1980 | 100 |
| Răteș/Tecuci | 16730 | 18360 | 43780 | 27700 | 82300 |
| Vărărie | 593 | 1245 | 1612 | 2104 | 140000 |
| Babadag | 2864 | 2861 | 3169 | 3290 | 37000 |
| Isaccea | 2100 | 2170 | 2370 | 2500 | 5000 |
| Aghighiol | 51074 | 53945 | 58325 | 71801 | 300000 |
| Măcin | 10240 | 10410 | 10545 | 10805 | 15000 |
| Sulina | 1701 | 1638 | 1971 | 1474 | 9769 |
| Golesti-Focsani | 59680 | 57385 | 55043 | 54827 | 150000 |
| Haret-Marasesti | 5477 | 4530 | 5754 | 5062 | 40000 |
| Odobesti | 3116 | 4344 | 5613 | 4497 | 25000 |
| Panciu | 4586 | 3984 | 3111 | 4051 | 57000 |
| Adjud | 8957 | 9264 | 9890 | 9890 | 135000 |

Source: from Warehouse Administration.

A collection such as "door to door" would give more positive results in neighbourhoods with houses and gardens, only those blocks. In neighbourhoods of blocks could arrange

"voluntary collection points" at which people selectively deposit recyclable waste. The next step in our research was to establish all data about the waste disposal such in table 7.

Table 7: Dates on Warehouse in South-East Developed Region.

| Disposal Name | Surface (ha) | Capacity (m ³) | Volume (m ³) | Free capacity (m ³) | Volume of waste in depot on year (m ³) | Number of inhabitants | Closed Year |
|------------------------|--------------|----------------------------|--------------------------|---------------------------------|--|-----------------------|-------------|
| Ianca | 0,97 | 9000 | 4500 | 4500 | 18000 | 9800 | 2009 |
| Braila - Muchea | 3,11 | 434000 | 120000 | 314000 | 70000 | 232000 | 2031 |
| Faurei | 2 | 37700 | 30000 | 7700 | 2000 | 4000 | 2017 |
| Nehoiu | 0,4 | 15000 | 4000 | 11000 | 2350 | 13000 | 2009 |
| Rm.Sarat | 2 | 950000 | 499500 | 450500 | 45000 | 25000 | 2017 |
| Galbinasi | 14,7 | 970000 | 34200 | 935800 | 70000 | 125000 | 2023 |
| Buzau | 10 | 1600000 | 1600000 | 0 | 0 | 125000 | 2010 |
| Cernavoda | 3 | 565000 | 290000 | 275000 | 11480 | 19500 | 2012 |
| Constinesti (celula 1) | 2 | 368000 | 230000 | 242000 | 10023 | 53.000 | 2019 |
| Basarabi | 2,6 | 432000 | 100000 | 60000 | 3600 | 11000 | 2015 |
| Techirghiol | 3 | 451000 | 120000 | 30000 | 15000 | 7200 | 2012 |
| Harsova | 5 | 150000 | 90000 | 60000 | 8900 | 10400 | 2010 |
| Negru Voda | 3,5 | 280000 | 140000 | 140000 | 6200 | 2500 | 2006 |
| Eforie Sud | 4 | 310000 | 160000 | 10000 | 8900 | 10000 | 2006 |
| Albesti | 22 | 3200000 | 1800000 | 1400000 | 130000 | 51000 | 2006 |
| Medgidia | 6 | 693500 | 632000 | 61500 | 61000 | 43634 | 2006 |
| Ovidiu | 16 | 7000000 | 3100000 | 3900000 | 390000 | 400000 | 2025 |
| Umbraresti | 1,15 | 12000 | 1500 | 9700 | 160 | 7637 | 2009 |
| Bazanu Beresti | 0,4 | 0 | 875 | 700 | 175 | 2700 | 2009 |
| Rates Tecuci | 3,5 | 210000 | 100000 | 110000 | 49200 | 45000 | 2017 |
| Tirighina | 2,5 | 5.000.000 | 413000 | 870 | 108000 | 320000 | 2014 |
| Isaccea | 0,25 | 9865 | 4800 | 5065 | 2500 | 5400 | 2009 |
| Babadag | 3 | 90000 | 35520 | 54480 | 4440 | 10135 | 2009 |
| Sulina | 1,2 | 25.000 | 17000 | 8012 | 1300 | 3278 | 2017 |
| Macin | 2 | - | 35970 | - | 5750 | 7500 | 2016 |
| Vararie | 1,2 | 25000 | 16987 | 8012 | 1300 | 92000 | 2007 |
| Aghiol | 5,2 | - | 1415000 | 500000 | 76500 | 92000 | 2015 |
| Odobesti | 1,4 | 168000 | 125000 | 43000 | 7000 | 8000 | 2009 |
| Haret - Marasesti | 2,2 | 120000 | 75000 | 45000 | 9500 | 10000 | 2017 |
| Panciu | 2,8 | 140000 | 78000 | 62000 | 8100 | 9000 | 2017 |
| Adjud | 3 | 360000 | 216000 | 144000 | 17000 | 21000 | 2017 |
| Golesti | 6,5 | 1300000 | 1100000 | 200000 | 110000 | 100000 | 2009 |

As we seen from this table there are some warehouse that must be closed from 2006. But because the closed of warehouse need money the administration extended the closing date thereof. Another problem is the lack of space for opening a new warehouse.

In addition, the specific conditions of the region in terms of topography (sea level to the Macin mountain), the prevalence of rural and urban areas, industrial and port existing and future protected areas many small and large (Danube Delta) steppe zones and coastal development and

4. Conclusions

Principles defined in the National Strategy for Waste Management which motivate the activities of waste management are listed below:

- The primary protection of resources - is formulated in the broader context of sustainable development with emphasis on the use of secondary raw materials;
- The measures preliminary concerns the application of existing state of technological development;
- The prevention establishes a hierarchy of activities of the waste management hierarchy to place first to avoid waste generation, minimize quantities eliminated and treatment to recovery and to eliminate the safe environmental and public environment;
- The polluter pays principle in line with the principle of producer responsibility and the responsibility of the user

tourism should be taken into account the establish objectives in south – east developed region. The introduction of collection in rural areas must take account of local characteristics, the existing infrastructure of roads and the location of some settlements from others and from transfer stations and landfill area existing or projected. The maximum distance from the economic point of view that can be made between the transport of waste transfer station and a warehouse area is not advisable to exceed 50-60 Km round trip.

requires a legislative framework appropriate and economically so that the waste management costs can be covered

- The substitution emphasizes the need to replace hazardous materials with hazardous materials to avoid generating hazardous waste;
- The proximity principle states that waste must be treated or disposed of as close as possible to where they were generated;

The principle of subsidiary establishes that the responsibilities must be allocated to the lowest administrative level to the source of generation, but on the basis of uniform criteria at regional and national level.

These principles are an integral part of regional objectives and targets. The objectives are in accordance to those approved by the National Plan for Waste Management that is in accordance with Romanian legislation on waste and environment and EU requirements.

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ILLEGAL IMMIGRANTS AS A THREAT OF THE MARITIME SECURITY

Raluca ENESCU¹

¹ Assistant Lecturer Ph. D. candidate, Naval Academy „Mircea cel Batran” Constanta

Abstract: *Taking their chances on fishing boats, dinghies and canoes, every year thousands of men, women and children drown in a desperate bid to reach Europe from Africa. They cross from West Africa to the Spanish Canary Islands, from Morocco to Southern Spain, from Libya to Malta and the Italian islands of Sicily and Lampedusa, and from Turkey to the islands of Greece. People entering Europe irregularly – without passports or visas – do so for a variety of reasons. In some cases they are fleeing persecution, human rights violations and armed conflict and can, therefore, be considered as refugees who need special protection. More often, they are migrants trying to escape poverty and unemployment.*

Key words: *illegal immigrant, maritime security, threat, refugees*

Taking their chances on fishing boats, dinghies and canoes, every year thousands of men, women and children drown in a desperate bid to reach Europe from Africa. People coming to Europe illegally – without passports or visas – have different reasons when doing this: they either want to escape persecutions, violation of armed conflict human rights or to escape poverty and unemployment.

In order to help governments the UN Agency for refugees started to enforce a 10 point plan which establishes key domains in which the necessity arises the states of origin, transit or destination. This decision was made as a result of the latest events that happened on the 27,28 March 2009, when out of a number of ships which were carrying a few hundred persons from the coast of Libia to Italy, at least one sank. The Egyptian authorities declared that some Egyptians were rescued, while some others drowned. Aboard there were North Africans and South Saharians.

The NHCR [1] in Rome, reports that two boats arrived in Italy within the week 23 – 30 March – one was transporting 244 people in Sicily, and the other one was carrying 219 people to Lampedusa.

In the last year 36000 people reached Italy coming from North Africa aboard ships; out of all these nearly 75% asked for political asylum and another 50% of them received a form of international protection from the Italian authorities [2]. This dramatic incident shows, once more, the dangers at which people caught in illegal emigration actions in the Mediterranean Sea, as well as elsewhere in the world, are exposed, death having, each time, its share. Globalisation was not evenly spread. Money circulates freely, goods have the same tendency, while people are constrained to remain stuck in a certain area, lacking freedom of movement [3]. This is a paradox. The more people move, the more barriers appear in their way, thus generating a situation in which one can hardly distinguish between authentic economic emigrants, asylum demanding people or refugees. The incident also stresses the necessity of international cooperation at sea, for rescue operations.

The media and most of the political discourses offer an apocalyptic image of the the exodus of desperate Africans, who are leaving poverty and war at home, and heading towards the elusive European „El Dorado”, crammed in boats that can barely float. The emigrants themselves are described as victims recruited by heartless and unscrupulous smugglers and traffickers [4].

The illegal migration from Africa towards Europe, over the Mediterranean Sea is not a new phenomenon. This has been deepening, as a phenomenon since 1990, when Italy and Spain requested visas. The greatest change was in

2000, when the Africans from South Sahara started to join the North Africans and then outnumber them, being considered as the largest category of emigrants that cross the sea in boats. There is a wrong concept saying that the greatest part of the emigrants who cross Sahara are in transit to Europe, but statistics say that although 65 000 and 120 000 Africans from the South Sahara enter Magreb [5], only 20 – 30% enter Europe. This policy revealed a series of hidden effects, in the form of the increase of human rights violation, diversification of emigration routes and checking the points of border passing. It looks impossible to find possibilities of crossing the border along the Saharian and African borders as well as along the European coasts, unless the European and African Governments are open to create this possibility.

Although the public discourses declare clearly that they should fight against illegal emigration, they seem to show little interest in stopping this phenomenon, since their economies became dependent on the work force of the emigrants. There is big discrepancy between the restrictive policy referring to emigrants and the request for cheap work force in Europe and Libia.

South Europe is used to illegal emigration from Magreb towards Europe. Ever since 1990 thousands of North Africans have been trying each year to cross the Mediterranean and reach Spain and Italy. The recent crisis of migration revealed a certain fact: a large number of emigrants from South Sahara headed to Libia, Algeria, Tunisia and Morocco, often using these regions as a transit point towards Europe, others remaining in the Magreb countries.

The image of the African emigrants climbing the high – fenced border that separates the Spanish enclaves Ceuta and Melilla, on the Mediterranean coast of Morocco, in the autumn of 2005, the daily attempts to cross the Mediterranean in small fishing boats, and the arrival of a large number of African emigrants on the shores of the Canary Islands, in the summer of 2006, have strengthened the perception of mass emigration of the Africans who have constantly been pushing the South – Eastern borders of Europe.

In the last years this problem was first on the political agenda of the European Union and of the member states. From 1990 on the European states have increased the borders' check points; this has implied deployment of military and non-military forces, in order to prevent emigration at sea.

North African countries have signed agreements of readmission to some conventions with some European states, often in exchange of financial and material help for the checking of the common borders, especially for Italy, and

have agreed upon the issuing of a small amount of temporary work permits for emigrants.

Having in view the recent increase of the trans-mediterranean migration of the South-Saharanians, Both Italy and Spain have signed similar agreements with the South-Saharan countries. Since 2003 Spain and Morocco, as well as Italy and Libya, started to cooperate through common naval patrols, and agreed on the readmission of the emigrants, asking for help in exchange. In 2006 Spain received help from FRONTEX, the new agency for exterior borders control of Europe to patrol the routes between Senegal, Mauritania, Green Cape and the Canary Islands by plane, helicopter or patrol ships. Frontex also intends to coordinate patrols implying Greece and Malta to monitor the area between Malta, the Italian island Lampedusa and the Tunisian and Lebanon coast. Media and politicians, most of the time, show this migration as being new, growing and massive. Media reports and political speeches give birth to an apocalyptic image of the exodus waves of desperate Africans who want to escape poverty and the war back home, in search of the European El Dorado crammed in boats that can hardly float. It is believed that millions of sub-Saharan Africans await in North Africa to cross over in Europe. These emigrants are seen as economic emigrants although disguised in refugees.

A big confusion in the debate regards the illegal migration from West Africa to North Africa and Europe and is related to the lack of definitions upon the primary concepts. First of all, these concepts apply to the illegal migration. Still the boundaries between the legal and illegal migrations are not always clear. First of all it is important to make a difference between legal and illegal stay. For example, most of the times emigrants enter the destination countries legally, but, afterwards, stay more than the visa established or engage in forbidden activities and thus earn the illegal status. On the other hand, immigrants that enter or reside in a country illegally can gain legal residence by working, marriage, etc. In the case of land migration from West Africa, emigrants go through several countries, some of which allow it; others do not allow this transition, and the emigrants either stay in regularity or not. We will give a broad definition of illegal migration and say that this is an international circulation, an international movement or a conflictual stay as contrary to the laws of migration, as well as the crossing of the borders without an appropriate authorization, or, also an infringement of the conditions referring to the admission in a foreign country. The emigrants use numerous routes, either on land and air or at sea in order to reach the desired destinations in the North of Africa or Europe. From the South of Libya the emigrants go to Tripoli and other coastal towns or to Tunisia, from where they continue to travel to Malta or the Italian islands Lampedusa, Pantelleria or Sicily in boats. From Morocco they make attempts to enter the EU by crossing the sea at the North or entering the Spanish enclaves Ceuta or Melilla.

The emigrants started to cross the Mediterranean Sea through the easternmost place of the Moroccan or Algerian coast towards Spain, from the coasts of Tunisia to the Italian islands, and from Libya towards Italy and Spain. Starting 2001 the number of emigrants who leave west Sahara, Mauritania, Green Cape, Senegal and others has increased; they usually use the traditional pirogues in their crossing towards the Canaries.

In the last years the emigrants from China, India, Pakistan, Bangladesh started to emigrate to Magreb on Saharian routes. Most of them fly from Asia to West or North Africa, and also from Egypt to Libya and Tunisia, from where they head towards Malta and Italy. In 2007 a great number of Asians joined the Africans in their travel to the Canary Islands. During the crossing of Sahara towards North Africa and finally to Europe the emigrants spend hundreds of dollars on smuggling and bribe, on transport and daily needs. In 2006 it was estimated that a boat that was crossing the sea from Morocco to Spain cost, for adults, from 200 to 500 or even 800 dollars, for Moroccans, and they could reach to 1200 for the francophones and anglophones from the South Sahara.

In order to emigrate from Libya Italy the costs were much similar to the above mentioned [6]. In a report for the media UNODC mention the price of 800 dollars for the route Morocco - The Canaries, and 480 \$ and 1930 \$, for the route Senegal - The Canaries. For the safer crossings (aboard cargo ships) the costs are much higher.

While the media focuses on the boats carrying people lots of African emigrants use other methods: tourist visas, false documents, hiding aboard cargo ships, climbing the enclosures of the Spanish enclaves Ceuta and Melilla, or swimming around them.

Every year a big number of emigrants die or are seriously injured while trying to reach the territory of the EU. The organization of Human Rights from Spain declared that at least 368 people died while trying to cross the Mediterranean Sea towards Spain, in 2006, although the real number is two or three times bigger, since some bodies were never found. The organizations for human rights estimate that 3285 dead bodies were found on the banks of the Gibraltar Strait, between 1997 - 2001. The real and actual number of the drowned people is estimated to be much bigger since a high percentage of the number of dead bodies were never found. In 2007 it was estimated that the death risk remained almost constant, being diminished with just 1%. The risk of crossing Sahara seems to be as big.

Whenever possible the Western and Northern Africans avoid entering Europe by using the dangerous means of fishing boats. In 2002 only 10% of the population emigrant managed to cross the sea illegally.

Once they arrived in Europe many emigrants manage to settle there. Only a small number are caught and sent back. In 2002 and 2003 only a quarter of the illegal immigrants in Spain were expelled, and more than 66.000 were freed. On the other hand their expelling is related to the difficulty that appears in their identification. The South-Saharan countries are not always willing to cooperate. Many emigrants destroy their documents in order to avoid being expelled; those who request asylum, underage people as well as pregnant women can usually stay temporarily on the basis of human rights provisions. Although the EU countries signed agreements for readmission with a great number of countries from Africa the expulsions are usually hard to be done. As a result the immigrants are detained for a maximum period of detention and are given a formal expulsion order. This is usually ignored, and the immigrants either leave for other countries or remain in Spain or Italy if they find jobs in agriculture, construction work, or services. A great number of them get residence either by marriage or by the help of campaigns of the Spanish and Italian authorities which provide entering into legal action [7]. The most important European destinations for the West Africans according to OECD [8] are France, England, Italy, Portugal, Spain and Holland. The emigrants from a number of African countries have as a destination the country that colonized them:

Two thirds of the emigrants coming from Benin, Chad, Gabon and Mali live in France; those coming from Ghana, Nigeria, Sierra Leone and Gambia head to Portugal, while the Liberians go to the USA; those from Senegal, Gambia, Mauritania, Guinea and Burkina Faso have Spain and Italy as a destination. If we take into account the births registered in the immigrant families in the main European countries, according to the statistics made in Spain, up to the year 2006, 3, 884, 573 children were born; in Italy [9] 2.670.514 children were born, and in Great Britain 4.865.563.

The number of persons that ask for international protection varied significantly depending on the year and country, according to policy, the evolution of the states of origin, or the introduction of strict policies in what the political asylum is concerned. However, there can be other relevant factors; the existence of different communities in the destination states, a willingness for receiving asylum requests, as well as the degree at which some states are willing to give the status of refugee. A great number of such factors can be attributed to the fact that lots of people cross the Mediterranean Sea, especially to settle on the Lampedusa Island (36 000 persons in 2008). In 2008 in Italy there were 31200 asylum requests were registered, more than double

the number of the previous year (14, 100 requests). In 2008, Italy became the fourth important destination among the industrialized countries of the world. It is also significant that in 2008 there were asylum requests from the 20 most important nations, except Serbia.

Nigeria was the most important state of origin whose people requests asylum in Italy, having 5300 requests

Conclusion

Except for the case in which some exceptional circumstances appear it is possible that the migration from West Africa to Magreb and Europe continue. There is big discrepancy between the restrictive migration policies and the request for cheap work force of the emigrants coming from Libya and Europe. This can explain why frequent border checks lead to a rapid deviation of the migration routes and to

registered, followed by Somalia with 4500 requests, Eritrea with 2700, and Afghanistan with 200 requests. In what the crossing of the Mediterranean sea is concerned The UNHCR estimates that in 2006 120000 emigrants tried to cross the Mediterranean each year. The International Centre for the development of migration policies estimated that 100000 illegal emigrants crossed the Mediterranean every year.

an increase of the risks, costs, and also to the increase of sufferings of the respective emigrants, rather to a decline in migration. As long as legal ways for migration are not created and the great informal economies will exist, it is possible that a substantial part of the migration remain illegal. The policies that fight against illegal migration not only incriminate it, but also can constitute the cause for the phenomenon that they pretend they fight against.

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BIOCHEMICAL PARAMETERS IN THE NAVAL PENTATHLON

Virgil ENE-VOICULESCU¹

Carmen ENE-VOICULESCU²

Onder ATAKAN³

¹ Senior lecturer Ph.D. Naval Academy „Mircea cel Batran” Constanta, Romania

² Professor Ph.D. *University „Ovidius” Constanta, Romania*

³ *Comander, Naval Academy, Tusla, Turkey*

Abstract: *Under consideration accomplished subdued research a series of the biochemical parameters (the hemoglobin, albuminoidal, lactic acid), who conditions the physical special effort. Hold the medical area (A. Demeter, 1982[3]; M. Ibrim, 1989[5]) propose in the process of selection grids with standard values have the parameters determinant in the system criterions of selection. Biochemical investigations suggested were effectuate in this experimentally stage to the initially and final moment. Through these inhibition of laboratory investigation we have follow:*

1. *If the results obtained frames in the natural suggested limits hold by the medical area specialist;*

2. *In what grey the investigations values obtained are influenced of the specific complex effort from the military pentathlon.*

The biochemical investigation realized demonstrated that the results obtained of subjects the group of the experiment they framed in natural physiological limits.

Key words: *the hemoglobin, albuminoidal, lactic acid, the urea*

Introduction

In speciality literature more majority of sports area sustain that sports training will be realize on base by criterions, who can be taken like a model for the efficiency in sport performance (N. Alexe, 1993[1]; N.J. Bulgacova, 1996[2]; A. Dragnea, 1996[4]). In this study we have selected the aspects which we can establish the contain and the structure on the level at military sports-man used main parameters presented in speciality literature to the discipline: soothing, athletics and swimming. In the same time we considered excellent used same testing who exist for this disciplines, with purpose verify objective to the subjects experiment.

Subjects and methods

The experiment group of our study was consisting to the military sports-man (age 18–25). Methodology research, the research methods was applied on monocycle period to eight month, adequate period to the selective and training process before National Naval Pentathlon Championship.

The analysis and interpretation of the results

The results obtained as part as both tests were statistically work (the table 1 - 2) and analyzed between groups research to the twice tests. Hemoglobin – the first

submissive parameter research is the conjugated protein or heteroprotein, that confer erythrocytes the main function of O₂ portents, composed by pigment fraction, that contains iron, appointed *hem* and albuminoidal fraction, from the class histonelor, appointed *globin* (Massage molecular the hemoglobin is 68. 000 - hem represent 4% and globins 96%). From the calculus difference significantly, they among average to the ultimate testing, between twice groups, it notices a semnificative difference, where t are expressed through the value 2,38>2,13 to the degree of freedom n-1, p= 0, 05. Knowing the fact from quantitative viewpoint the hemoglobin circulated is 600g - 800g, and the physiological mechanism for form's sake the ox hemoglobin is in progress to the level of pulmonary capillaries, O₂ frees to the level weaved, consider the significant results obtained by experimentally group are truthful. The albuminoidal represent of second parameter studied, through the biologic value and through the protean index have important distinguished in the physical effort. In accordance to the valuable standard this grid physiological parameter (6,5-7 g%), notice that to the initially testing (the table 1), average values are relative close (6,5 g% for the witness group and 6,4 g % for the experiment group).

The table 1

Analyses comparative to average of groups what characterized biochemical investigation to the naval sportsman's testing initially in the experimental stage 1

| Nr. Crt. | The parameters compares | $\bar{X} \pm m$ | | Criteria | |
|----------|-------------------------|-----------------|----------------------|----------|-------|
| | | Group witness | Group experimentally | “t” | “p” |
| 1 | Haemoglobin (grame %) | 13,60 ± 0,11 | 14,00 ± 0,07 | 0,95 | >0.05 |
| 2 | Albuminoid (grame %) | 6,50 ± 0,03 | 6,40 ± 0,04 | 2,00 | >0.05 |
| 3 | Uree (ml%) | 360,00 ± 3,08 | 355,00 ± 3,85 | 1,01 | >0.05 |
| 4 | Lactic acid (ml mol/l) | 10,60 ± 0,07 | 10,50 ± 0,06 | 1,11 | >0.05 |

The table 2

Analyses comparative to average of groups what characterized biochemical investigation to the naval sportsman's testing final in the experimental stage 1

| Nr. Crt. | The parameters compares | $\bar{X} \pm m$ | | Criteria | |
|----------|-------------------------|-----------------|----------------------|-------------|-------|
| | | Group witness | Group experimentally | “t” | “p” |
| 1 | Haemoglobin (grame %) | 14,70 ± 0,15 | 15,20 ± 0,15 | 2,38 | <0.05 |
| 2 | Albuminoid (grame %) | 6,90 ± 0,04 | 7,00 ± 0,04 | 2,00 | >0.05 |
| 3 | Uree (ml%) | 300,00 ± 2,31 | 295,00 ± 2,69 | 1,41 | >0.05 |
| 4 | Lactic acid (ml mol/l) | 10,00 ± 0,06 | 9,90 ± 0,06 | 1,25 | >0.05 |

Starting from the fact the necessity of albuminoid represent the amount of necessary albuminoid of the organism in 24 of hours, for the covering requirements loin of azoth, notice that to the ultimate testing the average values to this parameter breed. Although to this testing the difference among average is insignificant (t is 2, 00 < 2, 13, to p=0, 05), from physiological viewpoint, the value 7, 00 g % group experiment, express the fact that the muscular effort high it involved the degradation of the albuminoid spent and to own for the supply energetically necessary the muscular effort.

The urea comes from the combinations of the ammonia of the result from dissemination amino-acid with CO₂, result from the degradation of carbonic hatreds of glucose, lipids and albuminoid.

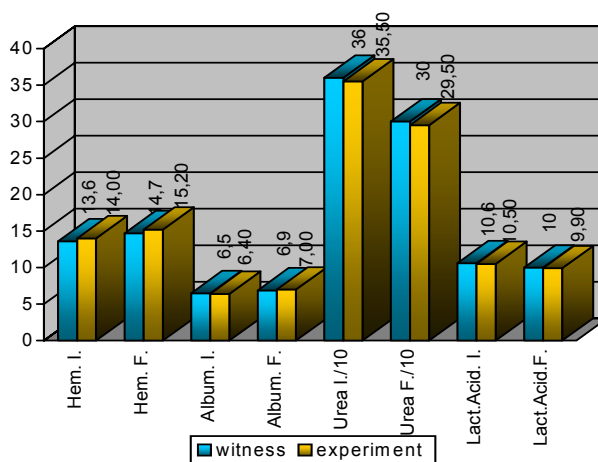
Choose the biochemical parameter urea in this investigation is motivated as a matter of fact as although the anabolism and the catabolism am diametrical opposite process, interaction reciprocally, anything synthesis realized on the expense of unbound energy through the of a decomposition a power substance. Starting from the premise biochemical of decomposition reactions, characterized at large through emission of energy causes finish of degradation produced (CO₂, H₂O, urea, uric acid, creatinin), carry eliminated through urine, notice (the table

1) to the first testing average values registered (360, 00 g% group the witness; 355, 00 g% group the experiment) are in the biochemical grid proposed of special physiologists hold this parameter.

To the ultimate testing the average values diminish progressively, group the witness registering 300, 00 g% and group the experiment 295, 00 g%. To the ultimate testing the calculus difference they among average between twice groups is insignificant to p= 0, 05 (t has the value 1, 4 < 2, 13).

The semnificative absence take statistically to this testing express the fact for the experimental lot subjects the chemical potential energy stored in feed substance and unbound through catabolic reactions is transformed of cells in energy mechanic (muscular contractions) and don't in osmotic energy (the activity of the cells renal tubes) pursuant to dosage the physical effort in practice on the of a coordinates the systems optimal of training.

The results obtained of twice groups subdued research were work statistically and represented it chart (the chart 1). The lactic acid, the ultimate term of degradation the glycogen and the glucose from the loop Embden – Meyerhoff, were selected in research for the determination of power level in conditions in which weaved have no to disposal the necessary oxygen in the time of specific effort.



The chart 1 The dynamics of the results to the biochemical investigations in the experimental stage 1

Directing to the fact all reactions involved in the loop Embden – Meyerhoff am reversible, what it's possible a new synthesis the glucose and the glycogen from lactic acid, consider to the ultimate these modification testing of

average values obtained are breaded because the specific effort good dozed. Thus, the muscular contractions they achieved in conditions of good oxygenation (1/5 from the lactic acid is degraded in the loop Krebs, to CO₂ and

H2O; with disengagement from energy again the remainder of 4/5 he is retransformed in glucose, respectively in glycogen).

Conclusions

The biochemical investigations realized was demonstrated that the results obtain from the subjects of the experiment group was in normal physiologic area.

Because of physiologic area the values of the urea and the lactic acid to the final testing presents positive modification insert in standard physiologic grind – the urea values

increase to 355g% at initial testing, to 295g% at final testing, which demonstrated thing that for experimental group, potential chemical energy insert in feed substance discharge through catabolic reactions is transformed by the cell in mechanical energy (muscular contraction). The values to average the lactic acid present to the final testing 9,90 ml mol/l, in the presence of 10,50 mmmol/l to the initial testing, the value what it's possible a new synthesis the glucose and the glycogen from lactic acid, the muscular contractions realized in better oxygen.

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THE STUDY SPECIFIC APPEARANCE PREPARATION PARAMETERS IN THE MILITARY PENTATHLON

Virgil ENE-VOICULESCU¹
 Carmen ENE-VOICULESCU²
 Nils Sverre HAUG³

¹ Senior lecturer Ph.D. Naval Academy „Mircea cel Batran” Constanta, Romania
² Professor Ph.D. *University „Ovidius” Constanta, Romania*
³ Professor Ph.D. *Telemark College, Oslo University, Norway*

Abstract: *In specify training investigation realized demonstrated that the results obtained of subjects the group of the experiment they framed to anticipate performance results. From the series five specify training parameters apply in research, from statistical viewpoint to the ultimate testing mark crease average values to the level experiment group.*

Key words: *shooting, obstacle race, swimming, throwing, cross country*

Introduction

In specialist literature more majority of sports area sustain that sports training will be realize on base by criterions, who can be taken like a model for the efficiency in sport performance (N. Alexe, 1993; N.J. Bulgacova, 1996; A. Dragnea, 1996). Through adapted existent testing from specialist literature, as through applied a new testing created by us we establish semnificative results in experimental stage 1.

Hypotheses

We propose that will be applied same operative systems specify to the training process on monocycle period to eight weeks will contribute to obtain equivalent values of specify physical parameters with the normal level at the training sports-man.

Subjects and methods

The experiment group of our study was consisting to the military sports-man (age 18 – 25). Methodology research, the research methods was applied on introductive monocycle period to eight weeks, adequate period to the

selective process after National Military Pentathlon Championship till the new training year.

The analysis and interpretation of the results

The testing specifies training appearance he achieved as part as the experimental stage 1 by characteristic skulls of military pentathlon, which skulls were applicant concomitantly for subjects the group of the witness and the experimentally group as much to the initial moment of the experimental stage 1, its last this.

The dates obtain in experiment period was elaborated statistic. After allocate the statistic parameters, the results permitted to comparative analyses a average of group who appearance specify training to the military sports-man so much to initial testing (table 1) how much to final testing (table 2).

Shooting

From the analysis of the date insert in the table 1, noticed that to the initial testing in first stage of the test, subjects of twice groups registered an average the score 75, 00 – 75, 40 points, equivalent the note 5.

The table 1
Analyses comparative to average of groups what characterized specify physical training investigation to the military sportsman's testing initially in the experimental stage 1

| Nr. crt | The parameters compares | | $\bar{X} \pm m$ | | Criteria | |
|---------|---------------------------|--------------------------|-----------------|----------------------|----------|-------|
| | | | Group witness | Group experimentally | “t” | “p” |
| 1 | Shooting | Rapid fire (points); | 75,00 ± 0,11 | 75,40 ± 0,07 | 0,95 | >0.05 |
| | | Precision fire (points); | 81,20 ± 0,38 | 81,00 ± 0,30 | 0,42 | >0.05 |
| | | Total fire (points); | 156,20 ± 0,23 | 156,40 ± 0,15 | 0,74 | >0.05 |
| 2 | Obstacle race | Relay 1 (sec.) | 26,00 ± 0,15 | 25,80 ± 0,23 | 0,74 | >0.05 |
| | | Relay 2 (sec.) | 28,02 ± 0,23 | 27,87 ± 0,23 | 0,48 | >0.05 |
| | | Relay 3 (sec.) | 29,01 ± 0,30 | 29,40 ± 0,26 | 1,44 | >0.05 |
| | | Relay 4 (sec.) | 37,17 ± 0,07 | 37,13 ± 0,11 | 0,30 | >0.05 |
| 3 | Obstacle swimming (sec.) | | 37,90 ± 0,23 | 37,60 ± 0,23 | 1,30 | >0.05 |
| 4 | Throwing (points) | | 150,00 ± 0,53 | 151,00 ± 0,46 | 1,42 | >0.05 |
| 5 | Cross country 8 km (sec.) | | 1784,00 ± 2,31 | 1779,00 ± 1,54 | 1,80 | >0.05 |

To the ultimate testing (the table 2), while subjects the group of the witness obtain an average in performance 80, 00 points (note 6), subjects the experimental group realize an average of score for the note 7, respectively 81, 00 points. From the graphic representation (the chart 1) notice in second part the event - shooting subjects of twice groups have obtain to the initial testing an average the approximate equal scores (81, 20 points - the equivalent scores of the note 6). Average

of the scores crease to the ultimate testing with 7, 8 points for witness group who obtain 89, 00 points (note 8) and with 9 points (note 9), for experimental group. The calculus significant difference among averages the scores realize to the ultimate testing between twice groups is represented of *t* with the value 3, 07 > 2, 95, to *p*= 0, 01, were significant difference.

The table 2

Analyses comparative to average of groups what characterized specify physical training investigation to the military sportsman’s testing finally in the experimental stage 1

| Nr. crt. | The parameters compares | | $\bar{X} \pm m$ | | Criteria | |
|----------|---------------------------|--------------------------|-----------------|----------------------|-------------|--------|
| | | | Group witness | Group experimentally | “t” | “p” |
| 1 | Shooting | Rapid fire (points); | 80,00 ± 0,38 | 81,00 ± 0,38 | 1,88 | >0.05 |
| | | Precision fire (points); | 89,00 ± 0,53 | 90,00 ± 0,46 | 1,42 | >0.05 |
| | | Total fire (points); | 169,00 ± 0,46 | 171,00 ± 0,46 | 3,07 | < 0,01 |
| 2 | Obstacle race | Relay 1 (sec.) | 24,73 ± 0,07 | 24,67 ± 0,07 | 0,66 | >0.05 |
| | | Relay 2 (sec.) | 27,76 ± 0,23 | 27,16 ± 0,15 | 2,22 | < 0,05 |
| | | Relay 3 (sec.) | 27,67 ± 0,23 | 27,37 ± 0,23 | 0,93 | >0.05 |
| | | Relay 4 (sec.) | 35,77 ± 0,38 | 35,47 ± 0,23 | 0,68 | >0.05 |
| 3 | Obstacle swimming (sec.) | | 37,50 ± 0,53 | 35,80 ± 0,46 | 2,42 | < 0,05 |
| 4 | Throwing (points) | | 158,00 ± 2,69 | 170,00 ± 1,92 | 3,63 | < 0,01 |
| 5 | Cross country 8 km (sec.) | | 1772,00 ± 3,08 | 1764,00 ± 2,31 | 2,08 | >0.05 |

Obstacle race

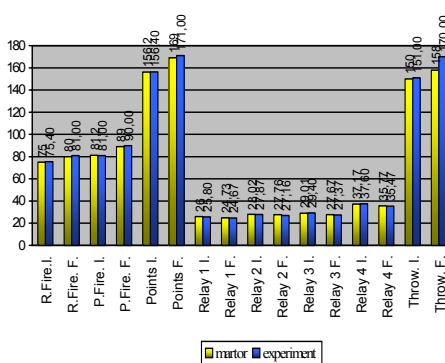
This event realized hatred chronometry and contained four moments (relay 1, 2, 3, 4) and 20 of specific obstacles.

From the comparative average analysis of groups what represented this event, notice to the initial testing (the table 1) as much subjects the lot of witness how much the experimental lot registered performance approached as value in all the submissive moments research. The difference among the averages performance realized to the initial testing between twice groups am insignificant to the degree of freedom n-1, *p*= 0, 05. To the ultimate testing, analyze comparative an average of groups (the table 2), confirm the fact that the averages performance obtained by subjects have bred progressively to both groups research. Crease is can noticed in the chart 1 – Relay 2. From the calculus significant take difference they among the averages obtained of twice

lots to the ultimate testing, notice that difference was significant statistically to the degree of freedom n-1, the threshold of significant 0, 05(*t* is expressed through the value 2, 22 > 2, 13).

Swimming with obstacles

The test realized in conditions of the swimming on distance of 50 m, with 4 specific obstacles (the gate, the raft, massage and the beam). From analyze comparative an average of groups realized to the initial testing (the table 1) notice that the averages performance obtained were close as the value (37, 90 sec. for the group the witness and 37, 60 sec. for the group the experiment. From the graphic representation (the chart 1) consisted to the ultimate testing a significantly difference between average (*t* with the value 2, 42 > 2, 13 to n-1, *p*= 0, 05), where significant difference in favor of the experimental lot.



The chart 1 The dynamics results skills specific training appearances in the experimental stage I

The throwing of the grenade

The performances realized of subjects of research to this test were compare e to international table of score. To the initial testing subjects of both groups have obtained environments of performances realized close scores as the

value (150 points the group the witness; 151 points the group the experiment). Signification takes difference they among average to the ultimate testing between twice lots is represented of *t*, carry expressed through the value 3, 63 > 2, 95, to n-1, *p*= 0, 01, difference were significant.

Conclusions

The performance obtained by the subjects experimental study to the characteristically events on military pentathlon, who selected in research, to components of specify training parameters, was demonstrated final of

research. On the comparative analyses average of specify performance obtained by the subjects experiment group to the final testing to events: shooting, obstacle race, obstacle swimming, throwing, cross country, represented the significantly values (n-1, *p*=0, 05).

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THE CONFLICT BETWEEN TURKEY AND GREECE REGARDING THE SOVEREIGNTY OVER THE CYPRUS ISLAND

Olimpiu Manuel GLODARENCO¹

¹ Cpt. cdor conf. univ. dr., Director, Muzeul Marinei Române

Abstract: *On 16 november1994, some twelve years after being opened for ratification, the 1982 Law of the Sea (LOS) Convention came into force. Less than one year later, the Greek parliament ratified the convention, a move that evoked a fiery response from Turkey, the only NATO nation that has not indicated an intent to do likewise. Labeling the Greek vote a casus belli, the Turkish parliament promptly authorized the government to take “all necessary measures, including military steps, deemed necessary to protect the vital interests” of Turkey. Simultaneous 1995 naval exercises in the Aegean Sea by the two nations did little to calm matters.*

Key Words: *aircraft, alliance, convention, embargo, invasion, security, territorial sea*

1. Introduction

The immediate cause of the controversy was the LOS Convention's allowance of a territorial sea of up to twelve nautical miles. Currently, the Greeks claim only a six-mile territorial sea in the Aegean. Should Greece extend it to the maximum allowable limit, the Aegean — as Turkey has repeatedly pointed out — would become a virtual “Greek lake”. Indeed, Turkish vessels traveling between the Mediterranean Sea and ports on the eastern coast of Turkey would have to pass through Greek territorial waters, a clearly unacceptable prospect from Turkey's perspective. Today, despite (qualified) Greek assurances that the ratification was not an attempt to expand its territorial reach, and even intervention by President William J. Clinton, the dispute continues to fester.

In actuality, the rift is more complex, and of greater lineage, than the recent focus on the territoriality component of the LOS Convention would suggest. Equally contentious disagreements exist over delimitation of the continental shelf (which contains oil deposits large enough to merit extraction), the breadth of Greek air space over the Aegean, Greek control of a flight information region in the area, and militarization of numerous Greek islands. The mere multiplicity of issues renders elusive the solution of any given one. But the dispute is deadly serious; at times the two NATO allies have approached the brink of war.

The importance of the dispute to all parties concerned, both regional and otherwise, is difficult to overstate. Greece has more than two thousand islands in the Aegean, some within five miles of the Turkish coast. Obviously, the security of, and sovereignty over, these islands is of paramount interest to Athens, while their presence so near Turkish shores has security implications for Ankara. The Turks are also concerned that they be assured high seas access to the Mediterranean and Black seas. Additionally, both states view control of Aegean airspace as a major security issue, and given the economic traumas experienced by Turkey and Greece over the past decades, the prospect of exclusive ownership of the Aegean oil reserves is highly attractive to the two.

Unfortunately, Greece and Turkey appear headed in different directions in the international arena, a fact that can only exacerbate the Aegean dispute. Turkey has concluded military cooperation agreements with Albania, The Former Yugoslav Republic of Macedonia, and Bosnia, whereas Greece, which almost went to war with the Macedonians over their selection of a national flag, has close ties to the Serbs and, in the view of some, has been noticeably lax in enforcing United Nations sanctions. The Armenian-Azerbaijani conflict is a second source of anxiety. While Turkey supports the Turkic Azerbaijanis, Greece has signed a military cooperation agreement with the Armenians. The current political situation also has economic overtones. Most recently, Turkey and Russia have been at odds over oil and gas pipelines from Central Asia. Partly in response, Athens, Sofia, and Moscow have agreed upon construction of a pipeline through Bulgaria

and Greece. The pipeline is particularly appealing to the Russians in that it provides an alternative to shipping oil from its Black Sea ports through the Bosphorus and Dardanelles. Finally, of particular import is Turkey's fervent desire to join the European Union, a possibility that Greece, an EU member, opposes.

As the political scenario evolves, both sides are enhancing their military forces. Between 1992 and 1994 Turkey acquired 1.605 main battle tanks; Greece added 1.410. Many of the transfers were the product of NATO's “Cascade” program, by which alliance countries required to dispose of equipment under the Conventional Forces in Europe treaty provide it to their southern NATO allies.

These events are occurring in the absence of a “tie that binds” - which the USSR used to be. In the past, the existence of a hostile superpower in the region forced Greece and Turkey to cooperate - at least to some extent and however uneasily - under the rubric of “my enemy's enemy is my friend”. Despite this incentive, tensions were high even during the Cold War. With the Soviet Union gone and a relatively docile Russia in its stead, the Cold War's moderating influence will no longer operate to cap potential conflict. Arguably, the Aegean is a much more delicate security environment today than it has been for decades.

Not surprisingly, both NATO and the United States are anxious about this state of affairs. Whereas the southern region used to be of secondary concern to an alliance facing a massive Soviet presence in central Europe, today the southern region is the front. NATO forces, having engaged in combat operations in the former Yugoslavia, are now committed there for peace enforcement. To complicate matters, nowhere is the likelihood of out-of-area operations for NATO greater than on Turkey's southern and eastern borders. A Greek-Turkish dispute could easily split the alliance just as its search for a new identity is bearing fruit. Further, the loss of either Greece or Turkey from NATO, à la the six-year Greek withdrawal following the Cyprus invasion, would have dire operational and planning consequences.

The impact of Greek - Turkish opposition was aptly illustrated last year when NATO considered establishing a regional headquarters in Greece. Turkey immediately moved to block the NATO budget, a response mirroring an earlier Greek veto of funding for a NATO headquarters at Izmir, Turkey. Though the budget controversy has since been resolved, such issues are illustrative of the alliance's susceptibility to internal disputes in this quarter.

American interests in the region are those of NATO, writ large. For instance, the United States, in collaboration with its French, British, and Turkish allies, is conducting *Operation Provide Comfort* from the Incirlik Air Base in southeastern Turkey. Should Turkish support for the operation falter, U.S. strategy vis-à-vis Iraq would be dealt a severe blow. The future value of Turkey, bordering as it does Syria, Iran, Iraq, and the most conflict-prone regions of the former Soviet Union, is self-evident. As for Greece, though most American bases there have closed, the country remains

important as a potential location to which U.S. forces could deploy, or through which they could transit. For instance, the air base at Hellenikon near Athens was critical during the Gulf war. Finally, both countries are important to the United States by virtue of significant bilateral trade, and both (particularly Greece) enjoy substantial political clout here.

Over the years, NATO and the United States have attempted to maintain stability in the area and search for common ground between Greece and Turkey. In 1995, for instance, Washington engaged in exploratory military-to-military talks focused on the Aegean-based disputes. Yet, as was demonstrated by the incident of January and February 1996 involving a tiny, uninhabited islet of the Dodecanese group, matters can deteriorate quickly in the region. When Greece placed a dozen commandos on the barren island of

2. Historical Context

That Greek-Turkish animosity is strongly etched in the national psyches of both countries is perhaps best illustrated by their respective national holidays: the Greeks celebrate the outbreak in 1821 of their struggle for liberation from the Ottoman Turks; the Turks commemorate Mustafa Kemal Atatürk's 1921 victory over the Greeks during their own war of liberation, which produced the Republic two years later. This hostility traces its roots to the fall of Constantinople to the Turks in 1453, after which it would be nearly four hundred years before an independent Greece would rise from the ashes of the Byzantine Empire. In 1829, victory in the Greek war of independence led to creation of the monarchy under a joint British, French, and Russian protectorate. Following the Russo-Turkish War of 1877-1878 and the 1881 Conference of Constantinople, the Greeks were able to consolidate further what is today central Greece. However, northern Greece, most importantly Salonika, remained in Turkish hands, as did many of the eastern Aegean islands.

The twentieth century would bring further Greek expansion. Greece's alliance with Serbia and Bulgaria during the Balkan War of 1912-1913 was designed in part to consolidate territories having a large Greek population. The Turkish defeat led to control of the Greek mainland, with the exception of Thrace. A second Balkan conflict in 1914 further enlarged Greek territory through the addition of Macedonia, Crete, and most of the eastern Aegean islands.

Following the First World War, Greek troops occupied much of western Anatolia, pursuant to a mandate by the war's victors. Under the Treaty of Sevres (1920), the populations of the occupied lands were to decide within five years whether to become part of Greece or Turkey; however, the uprising led by Atatürk against the sultanate foreclosed that possibility. Though nearly losing Ankara to the Greeks, Atatürk turned the tide, destroyed the Greek stronghold of Smyrna, and took control of western Anatolia. In 1923 the Treaty of Lausanne marked the end of hostilities. On the mainland the present Thracian border between Greece and Turkey was fixed, and Anatolia was granted to the Turks. In addition, Turkey accepted Greek sovereignty over the eastern Aegean islands of Lemnos, Lesbos, Chios, Samos, and Icaria, all of which had been seized from the Ottomans between 1878 and 1913. The treaty, together with the Straits Convention appended to it, also provided for demilitarization of the Bosphorus and Dardanelles straits; but to assuage Turkish concerns, numerous Greek islands in the region were either demilitarized or saw their previously demilitarized status confirmed.

In the 1930s, growing European concern over the threatening posture of Italy and Germany led to remilitarization of the straits, though freedom of navigation remained unimpeded, in the Montreux Convention. The Convention did not specifically address the status of the previously demilitarized islands, a fact that, as will be discussed, would prove problematic. Inevitably, the Second World War came to the region, with Greece being occupied after valiant resistance. Turkey elected to stay neutral until the waning days of the war. In 1947 the Treaty of Paris formally ended the state of war between Italy and the Allies,

Imia (Kardak in Turkish) and raised the Greek flag, Turkey vowed to retake it and sent naval and air forces into the area. Athens responded by deploying military units of its own. Calamity was avoided only through aggressive U.S. mediation and the eventual withdrawal of the Greek troops. The hostility and volatility displayed throughout the course of these events highlight the importance of pressing ahead to fashion a lasting *modus vivendi*.

It is the purpose of this article to highlight the points of contention between Greece and Turkey over the Aegean at this critical juncture in history. The dispute may be the most crucial issue facing the region, for whereas resolution would anchor NATO's southern tier, continued antagonism between the two antagonists could spell disaster, possibly even intra-alliance armed conflict.

and awarded the formerly Italian Dodecanese Islands, which lie just off the Turkish coast, to Greece. Though these islands had been Turkish until the Italian - Turkish War of 1912, there was little Turkey could do, given its neutral stance during the war, to prevent the transfer. Important to the present dispute is Greece's receipt of the islands on condition that they be demilitarized.

The onset of the Cold War and the entry of Greece and Turkey into NATO in 1952 ushered in a short-lived period of relative stability in Greco - Turkish relations. Cyprus, however, soon emerged as a source of contention. Great Britain had purchased Cyprus from the Ottomans in 1878, formally annexing it when Turkey joined the Axis in the First World War. The Greeks were in the majority on the island, but there was a substantial Turkish minority. By the Zurich Agreement of 1959, Great Britain agreed to grant Cyprus its independence. Soon thereafter, vocal Greek Cypriots began demanding *enosis*, or union, with Greece; simultaneously, many Turkish Cypriots made *taksim*, or partition, their rallying call. Matters had so deteriorated by 1964 that there occurred Turkish air strikes, and United Nations troops were dispatched to the island. A Turkish invasion was averted only when President Lyndon Johnson warned against the use of American - supplied weapons in any such operation.

In July 1974, however, when a coup resulted in the flight to London of the first president of Cyprus, Archbishop Makarios III, and his replacement by Nikos Sampson, an advocate of *enosis*, Turkey did invade. After a UN-sponsored cease-fire quickly fell apart, the Turks gained control of 30 percent of the island. In response to what it perceived as NATO inaction, Greece withdrew from the alliance. It also militarized the islands that had been demilitarized pursuant to the Treaty of Lausanne, the Straits Convention, and the Treaty of Paris. At the same time, under pressure from the powerful Greek lobby and upset over what it perceived as naked aggression, the U.S. Congress imposed an arms embargo on Turkey. The embargo, which lasted until 1978, had a major impact on the readiness of the Turkish military, whereas retributive Turkish restrictions on American military establishments in that country limited their operational effectiveness. The Cypriot affair soured both U.S. - Greek and U.S. - Turkish relations to such a degree that its impact continues to be felt. Today, Cyprus remains a virtual armed camp on either side of the UN - enforced "Green Line". In the late 1970s, Greece sought return to NATO, in part to offset what it perceived as growing Turkish influence within the alliance. As would be expected, the Turks initially opposed the move, making formal division of responsibility for the Aegean a condition for its approval. In 1980 General Bernard Rogers, the Supreme Allied Commander in Europe, eventually convinced the Turks to drop their objections, in what became known as the "Rogers Plan". Since that time Greece and Turkey have coexisted as "uncomfortable allies" under the NATO umbrella. Disputes between the two continue to surface, and if they are not on the scale of the 1974 Cyprus invasion, they have at times approached armed conflict. It is to the specific feuds over the Aegean that we now turn.

3. The Territorial Sea

The most important, and potentially divisive, disagreement over the Aegean concerns Greece's territorial sea. Since 1936 Greece has claimed a six-nautical-mile territorial sea. Turkey's claim in the Aegean is identical, but it extends to twelve nautical miles off both its Black Sea and Mediterranean coasts. Current claims leave three high-seas corridors across the Aegean that permit Turkish vessels departing east coast ports, such as Izmir and Kusadasi, to reach the Mediterranean without having to transit Greek waters.

Until the Third United Nations Conference on the Law of the Sea (UNCLOS III), which concluded in 1972, the issue of the breadth of territorial seas in the Aegean had caused little friction. Though many states had, unilaterally extended their territorial waters beyond the three nautical miles traditionally deemed appropriate (and recognized by the United States), Greece and Turkey's opposing six-mile limits had proven workable. However, UNCLOS III was convened in great part to resolve the issue of territorial sea breadth, resolution having proven elusive at the two previous conferences on the law of the sea, in 1958 and 1960.

It was an issue of enormous import for the Turkish delegation. Given the configuration of the Greek islands in the Aegean and the fact that islands are generally deemed to have territorial seas of their own, extension of the territorial limit would effectively turn the Aegean into the “Greek lake” the Turks feared. For instance, under the current scheme 35 percent of the Aegean Sea is Greek territorial sea; should the limit be extended to twelve nautical miles, that percentage would grow to 63.9 percent (with only 10 percent for Turkey). More importantly, a wide band of Greek territorial sea would stretch from the Greek mainland to the outer limit of Turkish territorial waters. This would mean that ships transiting to or from the eastern coast of Turkey, as well as those approaching or departing the Bosphorus and Dardanelles, would have to pass through Greek waters to reach the Mediterranean.

The problem is that with the exception of international straits (discussed below), all navigation through Greek waters would have to be “innocent passage,” a regime that seeks to balance freedom of navigation and sovereignty. Under customary international law as understood by the United States, and as adopted at UNCLOS III, innocent passage through a state's territorial sea must be both continuous and expeditious; it may include stopping and anchoring only as required by navigation or *force majeure*. Further, it must indeed be “innocent”, i.e., not prejudicial to the peace, good order, or security of the coastal state. Additionally, no fishing or research is allowed while in innocent passage. For that matter, no activity inconsistent with passage itself is permitted, absent approval of the coastal state.

Restrictions on military activities are even more severe. Any threat or use of force against the coastal state is obviously unacceptable; so too are such specific activities as military exercises, weapons firing, the launching, landing, or embarking of aircraft or helicopters, and intelligence collection. Submarines in innocent passage must surface and fly their flag. Warships violating these restrictions and subsequently disregarding a request for compliance may be required to leave by the coastal state. Perhaps most importantly, there is no innocent passage regime at all for aircraft. Thus, without Greek consent, Turkish aircraft would have no access to Aegean airspace (except transit passage through international straits); they would be forced to fly either circuitous overland routes to the north (themselves dependent on consent by bordering states) or far to the south over Mediterranean waters. To complicate matters, innocent passage may be temporarily suspended in specified areas for security reasons, though suspensions must apply equally to all nationalities.

At the time of UNCLOS III, the narrow territorial seas recognized by such maritime powers as the United States caused very few of the world's straits to be overlapped by national waters. However, their extension out to twelve nautical miles would subsume over a hundred. In light of the

innocent-passage restrictions, this was unacceptable to the maritime powers at the Conference. Warships passing through international narrows like the straits of Gibraltar, Hormuz, or Malacca would be forbidden from taking basic defensive precautions, and submarines, because of the requirement to surface, could be easily located by adversaries.

A satisfactory balance between the interests of coastal states and maritime powers in general was found in the “transit passage” regime. Transit passage is relevant to the Aegean situation because an extension of the Greek territorial sea would leave the high seas remaining in the northern Aegean and the Black Sea inaccessible by international waters. Under the transit passage regime, however, vessels are permitted to pass through international straits in “normal mode.” “International” straits are those used for navigation through a territorial sea which lies between one part of the high seas (or an exclusive economic zone) and another. For warships “normal mode” includes formation steaming and aircraft operation. Submarines may pass submerged, and, unlike innocent passage, aircraft are included in the regime. Movement must still be continuous and expeditious, and threatening activities are prohibited, but transit passage is non-suspendable. Though experts disagree over whether transit passage had already achieved the status of customary law at the time of UNCLOS III, the United States - the maritime power that would most be affected by the constraints of innocent passage - asserted in 1983 that it had. In any case, today, a decade and a half later, it is clear that transit passage has entered the corpus of customary international law.

As can be seen, Turkey had much at stake in UNCLOS III's handling of the territorial sea issue. At the Conference it advocated an approach that relied upon bilateral agreement between opposing coastal states for the delimitation of territorial sea boundaries. Turkey was not opposed to twelve-nautical-mile limits per se, as evidenced by its own claims in the Black and Mediterranean seas, but rather viewed the Aegean as a case of “special circumstances”. Accordingly, Turkey proposed forbidding territorial sea claims that would have the effect of cutting off a state's access to the high seas from its own waters. In cases of “semi-enclosed seas having special geographical characteristics” (a clear reference to the Aegean), the Turks argued, delimitation should be based on any combination of methodologies that was consistent with equitable principles; variables such as “the general configuration of the respective coasts and the existence of islands, islets or rocks” were of particular relevance. From the Turkish perspective, the Aegean was unique. It is a “semi-enclosed sea” and an important international sea route that lies between two coastal states having a history of conflict, and it is dominated by Greek islands, several in close proximity to the Turkish coast.

For its part, Greece was unwilling to acquiesce to a scheme that would permit a Turkish veto over the extent of the Greek territorial sea. In fact, it preferred to view its extensive island holdings as an archipelago, for the archipelagic regime emerging from the Conference would accord it sovereignty over an even greater proportion of the Aegean. Greece was to be disappointed in this effort by the Conference's definition of archipelagos as states consisting entirely of islands. The Turkish approach was also generally rejected; the Conference ultimately agreed that “every State has the right to establish the breadth of its territorial sea up to a limit not to exceed 12 nautical miles”. A specific article governing delimitation of territorial seas between states with opposite or adjacent coasts did, in fact, encourage bilateral agreement and prohibit extension beyond a median line equidistant from the respective baselines. Given the location of the Greek islands, however, this did nothing to allay Turkish concerns. Importantly, the LOS Convention explicitly confirmed that islands are entitled to a territorial sea of their own, determined according to principles applicable to coastal areas.

Unwilling to assent to this de facto confirmation of Greece's right to expand throughout the Aegean, Turkey refused to sign the Convention, a position it maintains today.

Greece, by contrast, did sign, albeit with a declaration to the effect that though its territorial limit remained six miles, it was reserving the right to extend that limit. This may have reflected a Greek fear that if it did not exercise the right it would lose it (though in fact the “use or lose” concept does not apply to treaty regimes). In any case, Greece made a similar declaration when depositing its instrument of ratification with the UN in July 1995.

In a clear expression of its security concerns at both signature and deposit, Greece also reserved (through an “interpretive declaration”) the right to determine which of its straits would be subject to transit passage, limiting all others to innocent passage: “In areas where there are numerous spread - out islands that form a great number of alternative straits which serve in fact one and the same route of international navigation, it is the understanding of Greece that the coastal state concerned has the responsibility to designate the route or routes, in the said alternative straits, through which ships and aircraft of third countries could pass under [the] transit passage regime, in such a way as on the one hand the requirements of international navigation and overflight are satisfied, and on the other hand the minimum security requirements of both the ships and aircraft in transit as well as those of the coastal state are fulfilled”.

The primary purpose of this declaration is most likely a Greek desire to keep Turkish aircraft from flying through straits near the Greek mainland, particularly the Kea Strait southeast of Athens. This appears contrary to the Convention’s specific intent with regard to transit passage and to its general effort to balance navigational freedoms and coastal state interests. Interestingly, Article 38(1) of the LOS Convention, known as the Messina Exception, would seem to satisfy any Greek concern along these lines: “If a strait is formed by an island of a State bordering the strait and its mainland, transit passage shall not apply if there exists seaward of the island a route ... of similar convenience”. This precisely describes the Kea Strait case; why Greece persists in its approach is unclear.

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BUSINESS COMMUNICATION – BETWEEN PAST AND FUTURE

Gabriela GOGOT¹

¹ Oil and Gas University from Ploiești

Abstract: *To communicate effectively means a change in a manner convenient thinking, feeling or behavior of speaker. Ability to communicate effectively means the centre of communication competence. First, the competence assessment context influences the content and form of communication. Communication skills is one that says that in a particular context and with a particular interlocutor, an argument can convince, and another not. A particular language may be appropriate and another may be inappropriate. The experience of human relationships and individual psychology and group knowledge are important ways to increase communication skills.*

Keywords: Business, negotiation, communication

Why is communication important to business? Couldn't we just produce graduates skilled at crunching numbers? Research spanning several decades has consistently ranked communication skills as crucial for managers. Typically, managers spend 75 to 80 percent of their time engaged in some form of written or oral

communication. Although often termed a “soft” skill, communication in a business organization provides the critical link between core functions. Let's examine three reasons why good communication is important to individuals and their organizations.

As Greece has expressly pointed out, it would be within its rights to extend its territorial sea, both under the LOS Convention and in accordance with customary international law. Turkey, however, refuses to acknowledge that right, holding that any Greek extension would constitute an abuse of rights under Article 300 of the Convention. That article provides that parties to the treaty “shall exercise the rights, jurisdiction and freedoms recognized in this Convention in a manner which would not constitute an abuse of right” - an argument that, ironically, acknowledges that the Greeks have such a right in the first place. More fundamentally, because Turkey is not a party to the Convention, its desire to benefit from the abuse-of-rights provision is somewhat questionable as a matter of law.

Regardless of any legal justification, the political costs of extension would appear to be enormous. Potentially an extraordinarily destabilizing step, it would seem measurably to increase the likelihood of hostilities. Turkey's security and commercial concerns are apparent and pronounced; from a purely practical perspective it might be justified in objecting to being limited to innocent or even transit passage through the area. Likewise, the area is of importance to NATO, which not only regularly conducts exercises in the Aegean but also relies upon unimpeded operational passage through it. Such activities would then require the acquiescence of Greece, which has not always been the most cooperative member of the alliance and has even displayed willingness to withdraw from it. The United States harbors similar concerns. Though the administration has forwarded the LOS Convention to the Senate for accession, and despite explicit U.S. recognition of its territorial and navigational principles as customary international law, a Greek extension could hypothetically be contrary to American navigational and operational interests. It would also operate at cross-purposes to the U.S. desire to assure Nato cohesiveness and also avoid having to choose sides in a dispute between two valued allies.

1 Ineffective communication is very expensive

Communication in a business organization provides the critical link between core functions. The National Commission on Writing estimates that American businesses spend \$3.1 billion annually just training people to write. The Commission surveyed 120 human resource directors in companies affiliated with the Business Roundtable, an association of chief executive officers from U.S. corporations.

According to the report of the National Commission on Writing:

- People who cannot write and communicate clearly will not be hired, and if already working, are unlikely to last long enough to be considered for promotion.
- Eighty percent or more of the companies in the services and the finance, insurance and real estate sectors—the corporations with greatest employment growth potential—assess writing during hiring.
- Two-thirds of salaried employees in large American companies have some writing responsibility.
- More than 40 percent of responding firms offer or require training for salaried employees with writing deficiencies.

2 The changing environment and increasing complexity of the 21st century workplace make communication even more important

Flatter organizations, a more diverse employee base and greater use of teams have all made communication essential to organizational success. Flatter organizations mean managers must communicate with many people over whom they may have no formal control. Even with their own employees, the days when a manager can just order people around are finished. The autocratic management model of past generations is increasingly being replaced by participatory management in which communication is the key to build trust, promote understanding and empower and motivate others. Because the domestic workforce is growing

3 The world's economy is becoming increasingly global

By the end of the 20th century, 80 percent of U.S. products were competing in international markets. The direct investment of foreign-based companies grew from \$9 trillion in 1966 to more than \$300 trillion in 2002. Many products we assume are American, such as Purina Dog Chow and KitKat candy bars, are made overseas. Brands we may think are international, Grey Poupon mustard, Michelin tires and Evian water, are made in the United States.

For managers, having international experience is rapidly moving from “desirable” to “essential.” A study by the Columbia University School of Business reported that successful executives must have multi-environment and multinational experience to become CEOs in the 21st century. The ability to compete in the global economy is the single greatest challenge facing business today. Organizations will want to negotiate, buy and sell overseas, consider joint ventures, market and adapt products for an international market and improve their expatriates’ success rate. All of this involves communication.

Products have failed overseas sometimes simply because a name may take on unanticipated meanings in translation: the Olympic copier Roto in Chile (roto in Spanish means ‘broken’); the Chevy Nova in Puerto Rico (no va means ‘doesn’t go’); the Randan in Japan (randan means ‘idiot’); Parker Pen’s Jotter pen (‘jockstrap’ in some Latin American markets). This type of mishap is not an American monopoly: A successful European chocolate and fruit product was introduced into the U.S. with the unfortunate name “Zit.” Naming a product is communication at its simplest level. The overall implications of intercultural communication for global business are enormous. Take the case of EuroDisney, later renamed Disneyland Paris. For the year 1993, the theme park lost approximately US \$1 billion. Losses were still at US \$1 million a day in 1994-95. There were many reasons for this, including a recession in Europe, but intercultural insensitivity was also a very important factor. No attention was paid to the

Tips for Communication

- Whether writing or speaking, consider your objectives. What do you want your listeners or readers to remember or do? To achieve an objective, you need to be able to articulate it.
- Consider your audience. How receptive will it be? If you anticipate positive reception of your message, you can be more direct.
- Consider your credibility in relation to your audience. Also, consider the organizational environment. Is it thick or flat, centralized or decentralized? Each will have communication implications.
- How can you motivate others? Benefits are always your best bet. And if you can establish common ground, especially at the opening of a message, you can often make your audience more receptive.
- Think carefully about channel choice, about the advantages and disadvantages of your choice, and the preferred channels of your audience.
- If you want to have a permanent record or need to convey complex information, use a channel that involves writing. If your message is sensitive, email may not be the best choice; the immediacy of face-to-face communication can be preferable, especially when you would prefer not to have a written record.

more diverse, an organization can no longer assume its employee constituencies are homogeneous. Employees reflect differences in age, ethnic heritage, race, physical abilities, gender and sexual orientation. Diversity is not just a matter of social responsibility; it is also an economic issue. Companies are realizing the advantage of making full use of the creativity, talents, experiences and perspectives of a diverse employee base.

Teams are the modus operandi in the 21st century workplace. In a recent survey of Fortune 1000 companies, 83 percent reported that their firms use teams; teams are all about communication. The collaboration that allows organizations to capitalize on the creative potential of a diverse workforce depends on communication.

European context or to cultural differences in management practice, labor relations, or even such simple matters as preferred dining hours or availability of alcohol and tobacco. EuroDisney signals the danger for business practitioners immersed in financial forecasting, market studies and management models when they overlook how culture affects behavior. Few things are more important to conducting business on a global scale than skill in intercultural communication.

The future of business communications looks less and less like a strict division between voice and data and more like a collection of communications components that can be blended with business applications as needed, according to opening day keynote addresses at the Internet Telephony conference Tuesday. Rather than considering VoIP as a separate communications function that happens to run over an IP network, voice itself will become just a tool that may or may not be useful within applications. The corporate communications becoming more broadly controlled than it is now, with most communications directed by groups of SIP proxy servers and presence servers that establish communications paths through business networks and publish information about how individuals are connected to the network. This is in contrast to thinking of communications as either voice or data or some combination of the two. As a result, businesses will lose the sense of a PBX as a free-standing device, and consider VoIP and its features as simply applications and features that can be blended with other applications to produce needed services. Related Content

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A simple example, he said, would be enabling business applications with presence information so a worker who spends most of the day working in a finance application wouldn't have to activate a separate application in order to communicate with a colleague about the work they are doing. Presence information about colleagues would be displayed in the finance application, with means available to contact them via voice, video, instant messaging or e-mail. "You shouldn't have to switch out of your business application to communicate with others," he says.

Key to this architecture is a presence engine that gathers information about how workers are connected to the network and by what means they can be contacted or prefer to be contacted. With free code for the essential elements of the architecture, businesses that want to develop integrated business/communications applications can do so less expensively and more quickly. These developers will then sell their applications to businesses as well as support services. Uniform presence information will eliminate the problems of

Novel aspects of Internet auctions

Internet is a new and evolving medium of communication. Its differences from other mediums of communication provide some advantages, and at the same time present some challenges. Most of the challenges arise from the fact that while open cry actions in the real world move rapidly with bidders responding to posted bids in seconds or sub seconds, Internet auctions must move at a slower pace because of Internet latencies. Some of the

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WHAT'S IN A NAME?

Ana ION¹

¹Asist. univ. dr. Ana Ion, Academia Navala "Mircea cel Bătrân" Constanța

Abstract: *Is a personal name just an artificial and meaningless convention? Does a name suggest anything when we pronounce it? So... "What's in a name? That which we call a rose By any other name would smell as sweet." (Romeo and Juliet -II, ii, 1-2) Would it? No doubt, Shakespeare was right.*

What we intend here is to make an attempt to trace back the origin of some names, and to show how they have perpetuated in time. This is an interesting and delightful subject that varies so much around the world and tells us so much about a country or society. Everywhere names themselves mean something, but often the meaning has been lost or obscured by time. The study of personal names is known as anthroponymy.

Key words: *anthroponymy, names, hypocorystics.*

The subject of names has been and will always be universal; all of us have a name or use names on a daily basis. Names provide a snapshot of culture. Meanings of names can reveal the values of the time. Names can provide some fascinating insights. Names connect us to the divine. So many names of the past and of our days make reference to gods and goddesses. The Hebrew god Yahweh appears in dozens of common names of today, such as Joshua and John.

Names link us to history. Thus, Alexander reminds us of Alexander the Great, Eleonore to Eleanor of Aquitaine. The subject is dynamic, since new trends are always emerging. Multicultural influences, creative spellings, and the ever-pervasive sway of popular culture means that the "pool" of names has changed noticeably.

First names (or given names) say so much about ourselves, our parents' aspirations for us, our family background, our cultural milieu. Our first names once marked us out as members of a particular culture, clan, family, or religion.

In some cultures, the Romanian one included, unlike in the English culture, the relationship between first

having to check several different places to retrieve voice messages and e-mails from several different accounts. Instead, a person will be able to check a central repository and get messages of all forms and an interface to contact the people who left them by any means - voice, video, e-mail, instant messaging, etc.

Business activity on the Internet is currently limited to publicizing the business opportunity and catalog based sales, but it will rapidly expand to include the negotiations conducted to settle the price of the goods or commodities being traded. These negotiations are currently conducted by human intermediaries through various forms of auctions, bidding systems for awarding contracts, and brokerages. The role of the intermediaries can now be performed by Internet trading applications at a fraction of the cost. Trading on the Internet allows a business to reach a larger number of potential customers and suppliers in a shorter time and a lower cost than possible by other modes of communication, and to settle business transactions with lower cost overhead in a shorter time.

advantages and challenges of Internet auctions are presented in this section.

Impact of Internet auctions

A traditional auction house, in addition to bringing buyers and sellers of similar commodities together, provides information about the quality or authenticity of the goods being auctioned and takes responsibility for delivery of goods and payment. As Internet auctions become more popular, these functions will also be supported on the Internet.

names and vocabulary words is transparent, that is the names are just special uses of ordinary words. They can be classified according to different characteristics, the most common of which being the zone of vocabulary they come from, as follows:

- a) botanical names, names of flowers or fruit - Floarea (flower), Brândușa (crocus), Lăcrămioara (lily-of-the-valley), Crenguța (branch), Cireașa (cherry), Mugur (bud)
- b) names of animals – Albina (bee), Puiu (chicken)
- c) common words – Alin/Alina (to soothe), Luminița (small light), Doru (longing)

As mentioned, this is not the case for English names (or for those in most Western European languages). English names are mostly opaque, that is the "meaning" is not obvious and is to be found in languages other than modern English, often ancient languages no longer spoken (such as Latin or Ancient Greek). Therefore parents choosing an English name for their child rarely do so because of the "meaning" of the name, but for esthetic or polyphonic reasons (they like the sound of the name) or personality (the name reminds them of a relative, close friend or person in the public domain). Nowadays, things stay the same with most

Romanian and European people, when it comes to select a name for a new-born.

A common source for both Romanian and English names (throughout the English-speaking world as well) is the Bible - male names like Adam, David, Jacob (Romanian Iacob), Joseph (Iosif) and female names like Eve (Eva), Rebecca (Rebeca) sound and are spelled alike in both languages. The New Testament gave us the names of the four evangelists, *Matthew* (Romanian *Matei*), *Mark* (Romanian *Marcu*), *Luke* (Romanian *Luca*) and *John* (Romanian *Ion*), and the apostles, principally *Peter* (*Petre*), *Andrew* (*Andrei*), *Thomas* (*Toma*), *Bartholomew* (*Bartolomeu*).

Many English and Romanian first names (like those of many other European countries) are derived from the names of saints - such as Anthony (*Anton*), George (Gheorghe, *George*), Gregory (*Grigore*), Stephen (*Ștefan*) for men and Catherine (*Caterina*), Ann (*Ana*), Mary (*Maria*) for women. Another common trait of the names appearing both in English and in Romanian refers to patterns used in name building. Both languages take the same linguistic rules; they create new names by shortening the existing ones. Thus, we can meet hypocoristics like Tony from Anthony, Vicky from Victoria, Tommy from Thomas, in English or Ica from Rodica, Uca from Raluca, Toni from Anton, in Romanian. Names in all languages are very much influenced by fashion. Characters in films, important names in sports, politics, public life in general, lend their names to common people. The Australian soap opera “Neighbours” - in which a young Kylie Minogue played a character called Charlene - led to the temporary popularity of both Kylie and Charlene in both Britain and Australia. Some names come in and out of fashion. A good illustration is the name Emily: there are lots of Emilys aged 60 and as large a number aged 20 or 25. Romanian names in fashion are also borrowed from names of famous stars, or from other languages: Pamela, Arnold, etc.

As a general rule, in recent decades British parents have become more selective in choosing names for their children. In 18th century England, roughly a quarter of babies were called either John or Mary but, from the 1960s onwards, parents have been more inclined to chose names that enable their children to stand out rather than fit in.

Importantly, in Britain the choice of names is very influenced by class. A boy called Jason or Wayne or Darren or a girl called Sharon or Tracy or Michelle is almost certainly from a working class family. A boy called Charles, Edward or Nigel or a girl called Felicity or Harriet is almost certainly from a middle-class family. A boy called Jasper, Rufus or Rupert or a girl called Camilla, Jemima, Lucinda or Petunia is probably from an upper class family. A final point about first names: the British - and the Romanians, as well, - often give their children more than one “first” name: Betty Mae, Billy Joe, Gloria Jean, while in Romanian we meet Ana -Maria, Maria Elena, or with French resonance, Marie-Jeanne, Anne. Also at a glance, we will try to touch a few aspects of family names

Family names did not until medieval times in the two above mentioned cultures. It was the Norman conquest of 1066 that introduced the practice to England. By 1400, most English families and those from Lowland Scotland had adopted the use of hereditary surnames. However, the Welsh only began to adopt the English system of surnames following the union of the two countries in 1536. Romanian family names began to appear at the middle of the 17th century and they were officially admitted only at the end of the 19th century, in 1895. Until these dates, many people adopted the name of their father, such as “John son of Richard” which over time became Johnson or “Simon son of Hugh” which became Hughes or “son of Stephen” which became Stephenson. The single first name William has given rise to Williams, Williamson, Will, Willett, Wills, Willis, Wilkins, Wilkinson, etc. The most common surnames derived from first names are those ending in “-s” or “-son”.

The situation is similar to the Romanian names, which add names of relatives or native places of the name bearer's: Petre, son of Gheorghe, Niculae brother of Maria, Simion from Brad, etc. Nicknames are also common to both cultures. Some people took names that referred to their appearance or character such as “John the Dear” or “Ralph the Pagan” which became Payne or “Henry the Blessed” which became Bennett. Names such as Fox (the name *Vulpe* in Romanian), from the crafty animal, or White (the name *Albu*, in Romanian), perhaps from the hair or complexion, are widespread. Many nicknames come from colour (such as *Blunt* meaning fair-haired and *Redhead* and *Russell* meaning red-haired), etc.

Many people adopted the name of the place where they originally came from, such as “John of Lewes” or “Matthew of London”, or, in Romanian *Ion Mihăilescu- Brăila*, *Octav Panu* *lași*. Others adopted names that referred to a geographical feature of where they lived or where they owned land. Sometimes the description was quite precise or detailed, such as *Aschcombe* meaning *a dweller in or near an ash tree valley* or *Denleigh* meaning *a dweller by a clearing in a valley*. Other examples are “John at the Ford” which became over time *Attford* or *Thomas of the ash-tree hill* which became *Ashdown*, etc. There are a great number of surnames derived from the word “hill”. As well as *Hill* and *Hills*, there are *Hull*, *Athill*, *Holt*, etc. Names like *Row* or *Rowe* refer to someone who lived in a row of cottages or houses by a hedgerow.

Some people were known by their occupations such as “**John the Baker**” or “**James the Taylor**”, etc. Indeed the three most common English surnames are **Smith**, **Wright and Taylor**. Cook and Turner are also very common. Most surnames ending in *-man* or *-er / or* usually imply a trade (**Shoemaker**). Old occupations, not existing today any longer, remained in names like: **Habbershaw**, a maker of hauberks (chain-mail coats) or **Slaymaker**, a maker of an instrument used in weaving. For Romanian we can give examples like: **Croitoru** (taylor), **Cizmaru** (shoemaker), **Cărciumaru** (inn keeper).

Although there is far more variety in surnames in Britain than in China, nevertheless in Britain we do have some very common surnames, such as *Smith* (over 500,000 people) and *Jones* (some 400,000 people). *Jones* means “son of John” and it is especially common in Wales (13.5% of the population) because of the Welsh habit of naming themselves after their father. In Wales, *Williams* is a very common surname too. In Scotland, *Donald* is very common. In Northern Ireland, surnames are so distinctive that local people can usually tell if someone is a Catholic or a Protestant just by knowing their surname. Some names are very likely to be Jewish like *Goldstein* or *Silverman*.

In what the use of names is concerned, we may state that in the Anglo-Saxon world (Britain, USA, Canada, Australia, New Zealand), calling someone by their surname is regarded as formal and respectful. In fact, almost every English first name has a diminutive - for example, Tony for Anthony, Jim for James, Frank for Francis, Liz for Elizabeth, Sue for Susan or Kate for Katherine. Sometimes the diminutive looks different from the original name - for instance, Bill for William, Bob for Robert, Jack for John or Dick for Richard. Sometimes people take a standard diminutive and give it an original spelling: from Victoria there are a lot of hypocoristics derived with different spellings - *Vicky*, *Vickie*, *Vikki*, *Vicki* (the name is common spelled as such, both in Romanian, and in English)

Some first names commonly used in English-speaking countries have equivalents in almost all European nations - notably John and George for boys and Mary and Ann for girls. However, each country has its own rich source for first names.

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TEAM SPORTS AS A NECESSITY FOR YOUNG PEOPLE

Riccardo Izzo¹

Urbino University “Carlo Bo”, Faculty of Motor, Sport and Health Science, Italy

Abstract: *Team sports are extremely good at satisfying the needs of young adolescents, both from a purely physical and psychological point of view. In fact, team sports tend to “mould” the character of the adolescent, making them more attentive to the people around them and therefore, more willing to understand, encourage and help those who are less able, trying out a new type of social relationship based on common interests and mutual respect, on working together. According to different authors it is above all the use of the lower limbs to encourage the activity and development of internal organs and the heart and lungs in particular. If, for example, we analyze some sporting disciplines, we can say that basketball is an activity that adolescents enjoy a great deal. It improves reaction speed, agility and balance and since tactics play an important role in a match and at any time, players can be called upon to perform combinations that are often rather complex, it also improves attention and the ability to reflect.*

Key-words: *team-sports, strength, endurance, neuromuscular sensitivity, coordination skills, motor imagination*

Introduction

Moreover, like all running-based games or activities, team sports increase the growth hormone in circulation. The muscles in the lower limbs are the first to develop during initial axiological development (and the first to become weaker during old age) and therefore, at this age, they require movement and exercise. Volley ball is also an excellent preventive motor activity, as also defined by Bonfanti and Ghizzo (Ita 1998) and its dynamic action on the lower limbs tends to improve any paramorphism of the spinal cord. It also teaches team spirit; in fact, differently to that which happens in other sports played with a ball, every athlete successively

Types of work involved in team sports

As we have already seen, basketball, volley ball and football involve a type of physical work that is known in physiological terms as MIXED, in the sense that during a match, all of the energy-producing mechanisms are involved. Trachelio (Ita. 1994), to define this type of work more specifically from a technical viewpoint, uses the concept STRENGTH ENDURANCE. It is work involving continuously variable rhythms and stimuli requiring responses that need great effort and, we might add, rapidity. In motor terms, overall the game is ACYCLIC, since it involves numerous movements of different types, with no pre-established performance; instead these movements are affected by the different playing situations each time, even if some of them, looked at individually, are CYCLICAL, for example, dribble, running and general movements in any direction.

Considering the above, according to various authors, it is particularly important for those who play volley ball but above all for those practicing basketball and football, to have the ability to maintain a condition of global and segmentary EQUILIBRIUM, both in static and dynamic states as well as during flight. The main factors on which to work when

Factors that characterise playing actions

With players who are always in movement, once one alternates phases of play and relevant recovery in proportion to playing times for a basketball, volley ball or football match, we can state that recovery times are much shorter for the first sport compared to the others, and that the actual stages of play are more intense. We can assert that attack and defenses actions are performed with a great degree of continuity and intensity (intermittent effort), above all in basketball, where movements and actions are for the most part, as described above, acyclic and with complex coordination characteristics. Movements and actions in basketball are performed quickly and within short spaces. Players' actions in basketball and football are performed with the constant opposition of the other team, which is usually more pressing in basketball. Generally speaking, muscular stress occurs where there is a lack of oxygen, i.e., during anaerobiosis, a highly characteristic feature of the sport in question, without forgetting the player's necessary energy-sustaining aerobic capacity, given the length of the games. The playing actions in football require a notable ability to put on a spurt and to accelerate, while the playing actions in volleyball require a good level of physical power in attack and good elevation skills (ability to jump). In volleyball, football

occupies every position on the court; there are no major roles, only specializations as players become older, where they take up positions according to their individual capabilities. It is in this specialty that we have the “universal” or multipurpose player which we feel should be the predominant focus for young players until around fourteen years of age. Football, which is the sport most played by adolescents in many countries the world over, improves resistance, muscle power, speed, organic resistance, dexterity, flexibility, balance and the use of lower limbs. The only problem, which needs to be taken into account during physical training, is that it does not adequately develop the upper half of the body.

teaching equilibrium are the support surface, height above ground, sight and dynamism. The ability to keep one's balance is fundamental in allowing any movement to start, interrupt, modify or completely change any motor response (MOVEMENT TRANSFORMATION SKILLS), encouraging a correct adaptation to the way in which the situation develops. To succeed in controlling a ball with balanced support, even in the most difficult situations and in order to maintain an optimum state of equilibrium in difficult unexpected situations, one needs finely-tuned NEUROMUSCULAR SENSITIVITY. The movements that need to be performed require a high degree of functional maturity, especially in basketball, which, also according to various authors, is to be sought in COORDINATION SKILLS of a good level, which establish the type of motor response to use after the perception and recognition of any stimulus, and in the CONDITIONAL SKILLS, which establish the intensity level of responses. As well as this, the success of a motor response is favored by the ABILITY TO CHOOSE the most effective action to take in any situation and at any time, out of all of the possible opportunities and using MOTOR IMAGINATION.

and even more so in basketball, acceleration and speed need to be repeated within short intervals of time from one another. Essentially, in team sports, young people, at least from a psychological viewpoint but not limited to this, undergoes an experience similar to that of life in a sort of general compendium where they themselves find a means of expression, with the proper guidance and support, achieving varied results that they need to compare and to deal with, whether positive or negative, and dealing with negative results is, as we know, seen as a great problem by today's generations. The culture of winning as the only possible result, as driven home by the whole system, from school to the home and perhaps, most seriously, the mass media, has created great imbalance amongst the groups of adolescents and even older people, who are now unprepared and often unable to find suitable answers. This causes them to respond exaggeratedly, out of proportion and out of line with socially balanced behavior. In this scenario, if used well, team sports can be extremely valid “test and training grounds” for life, with which they have a notable similarity, although unfortunately, this fact is not always recognized, above all by the various Institutions. We can only hope that this actually occurs as soon as possible, in fact and not just in words.

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FOCUSSING ON LANGUAGE: ERRORS AND CORRECTION

Edith KAITER¹

¹ Junior Assistant, PhD student, “Mircea cel Bătrân” Naval Academy Constanța

Abstract: *Errors often show that a student is experimenting with language, trying out ideas, taking risks, attempting to communicate. In this way, student errors are evidence that progress is being made. Therefore, one of the most important aspects is when and how to interfere and correct the errors that students sometimes make.*

The aim of the paper is to present ways of correcting errors, having as main purpose the students' motivation to learn more from their errors and not to feel guilty and start being afraid to express their ideas in a foreign language.

Keywords: *errors, correction, communication, feedback, confidence.*

Being a teacher and working with students, who are always eager to learn new things, is indeed a wonderful activity. But however, the most significant issue for any teacher is when and how to correct the mistakes of the students. Of course, there are a number of types of corrections that teachers are expected to make during the course of any given class.

Part of the job as a teacher stands for giving the students the kind of feedback that will help them learn and grow. Of course, one would want to do this in a way that encourages them to continue trying, and certainly not to hurt their feelings. It is already well known that some students are more sensitive than others, so giving constructive criticism can be a tricky thing. However, some ways to correct students without hurting their feelings would be:

To stay positive – the most important thing the teacher wants to remember when giving out correction is to keep his / her words and attitude positive. The main purpose is to make the student gain from the correction and learn from it. Being negative may only serve to bring down the student's self-esteem and give him a feeling of hopelessness. This way the student knows that the teacher sees the effort he made, and is telling him that it can be even better than it already is.

To know when to deliver correction – a student should never be embarrassed in front of the class. When a student walks into the classroom, the teacher is supposed to be responsible for him and trust should be built in students. If mistakes are pinpointed and corrections are made in front of the entire class, especially with negative comments, the student will be forced in this way to distrust the teacher. If there is no choice beside the one of correcting him in front of the whole class, the correction should be made in a rather friendly, positive and gentle way, so that the student should try and be able to avoid it next time.

To know the students – it is important for the teacher to know his students and their personalities as best he can. The way in which he delivers correction will probably need to be different for different students. All students react in a different way than others. Students who really try to make an effort will take correction to heart, whereas students who are not that ambitious may rub off correction and not care so much how the teacher delivers it. Either way, the teacher somehow needs to anticipate reactions.

To focus on the learner – it's important to let the learner self-correct. The teacher should remember that his students may well be capable of recognizing their mistakes if they are allowed enough time for this and some clues. Teachers often feel an urge to rush in with the correct response before students have had enough time to process the information. The least effective technique for correcting a student's incorrect language use is to simply give them the answer. It's much better for the students if they get into the habit of listening to themselves when they are speaking and correct themselves as they go along. Obviously they won't be able to correct all the mistakes they make but they will be able to correct a lot of them. The students' ability to correct themselves when they make a mistake is an important one for them to develop. The teacher should encourage it in this way and give them the possibility to correct themselves.

Not to use correction as punishment – in order for correction to be effective, it has to be used for the right reasons. Correction is not a form of punishment. Punishment is discipline. Correction is pointing out a way to change what was wrong, for example at grammar, vocabulary, pronunciation or written mistakes and make it better next time. A student shouldn't be criticized for doing something incorrect. Instead, as mentioned above, this should be transformed into a positive experience for the student; something he can apply the next time he tries a similar action or activity. Punishment should be saved for disruptive students, but not merely for correction.

To provide examples – correcting a student will work best when the teacher can provide examples of the right thing to do. Students should be given reasoning for the teacher's correction to help them clarify in this way what they did wrong. This help will offer them the motivation they need to make changes in the future.

To correct the work not the student – the teacher should keep in mind that correcting a student's work is not the teacher correcting the student itself. It is important for the student to understand that the teacher corrects his work, not who he is. The student should know and realize that the teacher is only trying to help improving his work and knowledge.

To request clarification – by using phrases like “Excuse me?” or “I don't understand”, the teacher indicates

that the message has not been understood or that the student's utterance contained some kind of mistake and that a repetition or a reformulation is required. In this way, the student is indirectly forced to reconsider his answer, analyzing it better. The teacher can also come up with **metalinguistic clues**. Without providing the correct form, the teacher poses questions or provides comments or information related to the formation of the student's utterance (for example, "Do we say it like that?" "That's not how we say it in English," or "Is it plural form?"). **Repetition** is also useful. The teacher repeats the student's error and adjusts intonation to draw the student's attention to it.

With oral mistakes made during class discussions, the teacher can choose between interfering and correcting often and thoroughly or letting the students make mistakes. Sometimes, teachers refine the choice by choosing to let beginners make many mistakes while correcting advanced students often.

However, many teachers are taking a third route these days. This third route might be called 'selective correction'. In this case, the teacher decides to correct only certain errors. Which errors will be corrected is usually decided by the objectives of the lesson, or the specific exercise that is being done at that moment. In other words, if students are focusing on simple past irregular forms, then only mistakes in those forms are corrected and other mistakes, such as mistakes in a future form, or mistakes of collocations are ignored.

Finally, many teachers also choose to correct students after the fact. Teachers take notes on common mistakes that students make. During the follow-up correction

session the teacher then presents common mistakes made so that all can benefit from an analysis of which mistakes were made and why.

The following scenario is also possible: many teachers feel that if they do not correct mistakes immediately, they will be helping reinforce incorrect language production skills. This point of view is also reinforced by students who often expect teachers to continually correct them during class. The failure to do so will often create suspicion on the part of the students.

In the case of written mistakes, there are three basic approaches to correcting written work: to correct each mistake, to give a general impression marking or underline mistakes and/or to give clues to the type of mistakes made and then let students correct the work themselves.

Learning a language is a long process during which a learner will inevitably make many, many mistakes. In other words tiny steps are taken from not speaking a language to being fluent in the language. In the opinion of many teachers, students who are continually corrected become inhibited and cease to participate. This results in the exact opposite of what the teacher is trying to produce - the use of English to communicate. Correction is not an 'either/or' issue. Correction needs to take place, and it is somehow expected and desired by students. However, the manner in which teachers correct students plays a vital role in whether students become confident in their usage or become intimidated. Correcting students as a group, in correction sessions, at the end of activities, and letting them correct their own mistakes all help in encouraging students to use English rather than to worry about making too many mistakes.

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DIE BEDEUTUNG DES WECHSELS VON SOZIALEN ORGANISATIONSFORMEN IM FREMDSPRACHENUNTERRICHT DIE EINFÜHRUNG VON GRUPPENARBEIT

Olga KAITER¹

¹ Lektor Dr., "Ovidius" Universität Constanța

Kurzfassung: Infolge des Prozesses der Globalisation und des näheren Zusammenrückens in der Welt stellte man fest, dass das Lernen von Fremdsprachen eine wichtige Voraussetzung für die Kommunikation geworden ist. Die intensiven menschlichen Kontakte im Bereich der Wirtschaft, der Kultur und des Tourismus, die nun vom gesellschaftlichen Wandel in der Welt bestimmt wurden, setzten die Verständigung mit anderen Sprechern voraus. Wenn man die Ziele des kommunikativen Fremdsprachenunterrichts in Betracht zieht, dann sieht man die Notwendigkeit der Vermittlung von neuen Lernstrategien und Lerntechniken ein, die den Lernenden im Lernprozess der Fremdsprache helfen und sie auf die Kommunikation vorbereiten.

Ein wichtiger Aspekt in der Arbeit ist die Sensibilisierung der Lehrenden für den Wechsel von sozialen Organisationsformen, die die Unterrichtsroutinen auflösen und den Raum für das Neue schaffen.

Schlüsselwörter: Wechsel, Organisationsformen, Fremdsprachenunterricht, Gruppenarbeit, Lernstrategien

Im Laufe der Jahrhunderte und besonders stark nachdem dem Ende des zweiten Weltkriegs veränderten sich die Grundlagen des Unterrichts aufgrund der Veränderungen, die in den allgemeinen Schulen zunächst in den Ländern Westeuropas und in Nordamerika stattfanden. Der Höhepunkt wurde in den 70er Jahren dieses Jahrhunderts erreicht, als Konzepte über Lernen entstanden, die zuerst zu Beginn dieses Jahrhunderts in Privatschulen eine „Erprobungsphase“ durchliefen. Diese neuen Konzepte verursachten vor allem im Fremdsprachenunterricht viel Unruhe und zahlreiche Fragen wurden aufgeworfen.

Eine wichtige Frage war die nach den sozialen Organisationsformen im Fremdsprachenunterricht, der nun auf fremdsprachliche Kommunikation der Lernenden innerhalb und ausserhalb der Klasse ausgerichtet war, und für den das traditionelle Unterrichtsverfahren keine ideale Form darstellte.

Besonders infolge des Prozesses der Globalisation und des näheren Zusammenrückens in der Welt stellte man fest, dass das Lernen von Fremdsprachen eine wichtige Voraussetzung für die Kommunikation wurde. Die intensiven menschlichen Kontakte im Bereich der Wirtschaft, der Kultur und des Tourismus, die nun vom gesellschaftlichen Wandel in der Welt bestimmt wurden, setzten die Verständigung mit anderen Sprechern voraus. Hierfür wurden die grammatische Kompetenz, ein flexibler Wortschatz, eine angemessene Aussprache und besonders die Kompetenz erforderlich, Sachverhalte, für die ein angemessenes semantisches grammatisches Wissen noch fehlte, zu umschreiben. Unter diesen Umständen haben sich die Haltungen der Lernenden und somit auch der Lehrenden verändert, die nun den Lernenden neue Lernstrategien und Lerntechniken vermitteln müssten, die ihnen im Lernprozess der Fremdsprache helfen und sie auf die Kommunikation vorbereiten könnten.

Von entscheidender Bedeutung sind jedoch die Ziele, die im kommunikativen Fremdsprachenunterricht verfolgt werden. Während im traditionellen Fremdsprachenunterricht die Sprachbeherrschung eines Muttersprachensprechers durch das Lernen der Aussprache und der grammatischen Formen angestrebt wird, stehen im kommunikativen Fremdsprachenunterricht die Bedürfnisse der Lernenden im Vordergrund, die immer um die Strukturierung und Restrukturierung ihrer Aufgaben bemüht sind. Die Lernenden werden als Aushandelnde und Interagierende gesehen, die unmittelbar am Lernprozess teilnehmen. Der Lernprozess wird in diesem Fall nicht nur vom authentischen Material, das den kommunikativen Sprachgebrauch erfolgreich ermöglicht oder durch kommunikative Arbeitsaufträge unterstützt, sondern viel mehr durch einen Wechsel der Organisationsformen, die die Unterrichtsroutrinen auflösen und den Raum für das Neue schaffen.

In den jüngeren Studien wurde gezeigt, dass der Einwand gegen Gruppenarbeit, sie sei eurozentrisch, eine Schutzbehauptung ist, durch die den Schwierigkeiten, die natürlich auftreten, aus dem Wege gegangen werden kann.

Die Unterrichtspraxis hat nachgewiesen, dass es notwendig ist, zuerst die Fremdsprachenlehrenden für unterrichtliche Möglichkeiten zu sensibilisieren, die der Wechsel von Organisationsformen anbietet. Die Sensibilisierung der Lehrenden für die Sozialform Gruppenarbeit ist ein wichtiger Schritt für den Fremdsprachenunterricht. Die Entscheidung des Lehrenden für die Gruppenarbeit vermutet auch die Bewusstmachung mancher Aspekte, die während der Unterrichtsstunde unabhängig vom Thema, das bearbeitet wird, oder vom Alter der Gruppenmitglieder, auftreten können: Unruhe und Nervosität bei der Gruppeneinteilung, viel Lärm durch das Umstellen von Stühlen, Geräusche und Unruhe im Verlauf von Gruppenprozessen, die Möglichkeit, dass eine Gruppe gar nicht zueinander findet, die Möglichkeit, am non-verbalen Verhalten der Gruppen abzulesen, ob die Gruppen intensiv arbeiten oder ob sie Probleme haben, mögliche Unklarheiten bei der Aufgabenstellung für die Gruppen, die nachfragen bei den Lehrenden erforderlich machen. Der Austausch von Gruppen untereinander, wenn Unklarheiten bestehen, Schwierigkeiten bei der Auswertung der Gruppenergebnisse, Schweigen kann eintreten, wenn die Gruppen ihre Berichte präsentieren müssen, u.s.w.

Ein Wechsel der sozialen Organisationsformen, bzw. der Sozialform Gruppenarbeit löst bedeutende Veränderungen auf der Ebene von Gefühlen sowohl bei den Lehrenden als auch bei den Lernenden aus. Den Lernenden wird gezeigt, dass selbstverantwortliches Lernen in Gruppen, **Gründe für die Einführung der Gruppenarbeit**

Die psycholinguistischen Akzentsetzungen in den Studien spiegeln die Tradition der anglo-amerikanischen Fremdsprachenerwerbervorschung wieder. Long stellte in seiner Studie fest, dass sich die Qualität der Äusserungen der Lernenden verändert, wenn sie in Gruppen arbeiten. [4] Sie werden mehr Versuche machen und sich auch dazu ermutigt fühlen, „ins Unreine zu sprechen“, das heisst den Versuch unternehmen, ihre Gedanken tastend in der Fremdsprache zu formulieren. Long übernahm diese Konzepte aus der britischen pädagogischen Diskussion, bei der nicht speziell das Fremdsprachenlernen im Zentrum stand. Durch den Umstand, dass es in der Gruppenarbeit möglich ist, den Lernenden unterschiedliche Rollen zuzuweisen, verändert sich auch der Sprachgebrauch der Lernenden in der Gruppe. So erhalten sie die Gelegenheit in der Gruppenarbeit vermehrt Sprechakte zu äussern, wie z.B.: Definitionen geben, Hypothesen bilden, sich entschuldigen, Anweisungen geben, Zweifel, Wissen, Überzeugung, Glauben, Vermutungen, Meinungen ausdrücken, u.s.w.

In Zusammenarbeit mit Porter knüpft Long an seiner frühen Arbeit an und erweitert sie, um eine Zusammenfassung der Ergebnisse psycholinguistischer Arbeiten zur Gruppenarbeit, die auch heute Anerkennung finden. Die Forschungsergebnisse berücksichtigen einige wichtige Aspekte, wie z.B.: die Gruppenarbeit schafft mehr Möglichkeiten für einzelne Lernende, im Unterricht zu

auch den Umgang mit den dabei entstehenden Gefühlen umfasst. Die Gefühle, die Emotionen spielen eine grosse Bedeutung für das fremdsprachliche Lernen besonders in Gruppenarbeit; sie können die Lernenden anregen oder hindern allein oder in Gruppen an einer Auseinandersetzung teilzunehmen. Daher kann eine Reflexion dieser Zusammenhänge in einer angemessenen Betrachtung eines Einsatzes wechselnder sozialer Organisationsformen auf keinen Fall vernachlässigt werden. Shweder charakterisiert das Verständnis von Emotionen dem heutigen Vorschungsstand angemessen: „Emotionen sind weder Konzepte oder Dinge oder Begriffe einer Sprache. Sie sind komplexe narrative Strukturen, die körperlichen und seelischen Zuständen (z.B. Anspannung und Leere) Form und Bedeutung geben. Ihre Einheit wird nicht in streng logischen Kriterien gefunden, noch in wahrnehmbaren Merkmalen von Gegenständen, sondern in den Typen von Geschichten, die sich um das Selbst einer Person drehen, die es uns möglich machen, über unsere Gefühle zu sprechen.“ [1] So sind Emotionen überwiegend immer auch soziale Handlungen, mit denen etwas erreicht werden soll.

Die Aktivitäten der Lernenden im Fremdsprachenunterricht, die mit dem Wechsel der sozialen Organisationsformen gewünscht sind, sind darauf gerichtet, die Emotionen der Lernenden „zulassen“, den Emotionen sind bei Menschen immer vorhanden, egal wo sie sich aufhalten, also auch immer im Fremdsprachenunterricht. Alle Vorgänge und Handlungen beeinflussen sowohl die Lernenden als auch die Lehrenden aber unterschiedlich. Die Lehrenden beunruhigt die Entwicklung von Emotionen in den Gruppen, die sich störend auswirken können und somit eine gemeinsame Zuwendung zu einem Arbeitsauftrag vereiteln können.

Bertcher weist auf drei verschiedene Möglichkeiten hin, mit den Gefühlen, die in Gruppen durch einige Gruppenmitglieder hervorgerufen werden, umzugehen: man kann die Gefühle zur Kenntnis nehmen, ohne diese zu reagieren, man kann andeuten, dass man die Gefühle zur Kenntnis genommen hat und auch versteht, ohne jedoch auf sie einzugehen; die Gruppe wird ermutigt an der Aufgabe weiter zu arbeiten, oder man kann die Arbeit in der Gruppe unterbrechen und sich auf das negative Gefühl und seine Ursachen konzentrieren. [2]

Die Lehrenden müssen die Natur der Gefühle in der Gruppe feststellen und angemessene Entscheidungen fällen. Ausserdem müssen sie eine Atmosphäre des Vertrauens im Unterricht schaffen, die es den Lernenden ermöglicht, frei zu ihren Gefühlen zu stehen, ohne damit den Arbeitsprozess der Gruppen zu beschädigen. [3]

sprechen; die grammatische Genauigkeit der Äusserungen der Lernenden unterscheidet sich nicht von der grammatischen Genauigkeit der Äusserungen der Lernenden im Frontalunterricht.

Wenn die Aufmerksamkeit der Lernenden auf die Wahrnehmung und Korrektur eigener und fremder Fehler gerichtet wird, zeigt sich in Gruppenarbeit eine erhöhte Bereitschaft zur Korrektur vor allen Dingen lexikalischer Verstösse; das Aushandeln von Bedeutungen tritt zwischen Lernenden in Gruppenarbeit viel häufiger auf als zwischen einem native speaker und einem Lernenden. Es wurde beobachtet, dass die Bereitschaft zum Aushandeln von Bedeutungen steigt, wenn die Lernenden einen unterschiedlichen muttersprachlichen Hintergrund haben;

Bygate legt in seiner Studie zur Gruppenarbeit im Fremdsprachenunterricht grossen Wert auf die Untersuchung der gesprochenen Sprache. Er meint, dass in der Gruppenarbeit die Sprechflüssigkeit in der Fremdsprache am meisten eingeübt werden kann und diese grössere Sprechflüssigkeit kann nur durch konstante Übung erreicht werden. [5]

McGroarty setzt die Argumente von Bygate über die Förderung der gesprochenen Sprache durch Gruppenarbeit fort, die sie ihrerseits durch eigene empirische Daten stützt. Sie nennt fünf psycholinguistische Aspekte, die durch das Lernen der Lernenden voneinander gefördert werden: die Gruppenarbeit gibt mehr Gelegenheit, die

Sprachproduktion der Lernenden zu fördern, ein Prozess der in gleicher Weise die Sprachrezeption der Lernenden erweitert; die Lernenden produzieren redundanter Sprache für einander, die dann eine Grundlage für das Lernen grösserer Sprechflüssigkeit und grösseren Verstehens bildet; die Sprachproduktion führt dann zu einer höheren Sprechgenauigkeit der Lernenden; es werden dem Lernstand jeweils angemessenere linguistische Einheiten von den Lernenden für die Lernenden produziert; die Diskursmuster, die die Lernenden untereinander produzieren sind vielfältiger. [6]

Eine wichtige Rolle für diese Phänomene haben die Aufgaben, die in der Gruppenarbeit zu bearbeiten sind und die dieser Unterrichtsform Gruppenarbeit angemessen sein muss.

Angemessene Aufgaben sollten die Aufmerksamkeit auf das Wesentliche lenken, ihr Ziel von den kommunikativen Bedürfnissen der Lernenden ableiten, offene Zugänge zu den jeweiligen Aufgaben ermöglichen, die Wege zur Lösung der Aufgaben sollten unterschiedlich sein, ebenso die erforderlichen Medien, die Einbindung der Lernenden und die Vorgehensweisen, die Sprachverwendung fördern, unterschiedliche Lösungen ermöglichen in Abhängigkeit von den Fertigkeiten und Strategien, die den Lernenden zur Verfügung stehen. Die Aufgaben sollten auch darauf gerichtet sein, persönliche Beiträge der Lernenden, persönliche Haltungen und Gefühle einzubinden, den Lernenden Bewusstheit über die Lernprozesse schaffen, an denen sie teilnehmen, und so gestaltet sein, dass die Bewältigung der

Aspekte der Aufgaben nützlich für die Kommunikation ausserhalb der Klasse sind. [7]

In der letzten Zeit sind qualitative Studien über lernschwache Lernende erschienen, in denen betont wird, dass die schwächeren Lernenden besondere Schwierigkeiten mit der für Fremdsprachenlernen angemessenen Entwicklung von Lernstrategien haben und deshalb ist der Wechsel von sozialen Organisationsformen erforderlich. Die Lehrenden müssen darauf achten, dass die Lernaktivitäten so nah wie möglich an die Situation, in der sie die Sprache brauchen, angelehert werden sollen.

Ausserdem müssen sie ins Auge fassen, dass es nicht die einzig richtigen Lernstrategien gibt. Die Lernstrategien sollten der Aufgabe gemäss und angemessen für den Lernenden sein. Ein erfolgreicher Wechsel in den sozialen Organisationsformen des Fremdsprachenunterrichts ist abhängig von der Haltung und Einstellung der Lehrenden. Der Fremdsprachenunterricht soll den Lernenden nicht nur Spass machen, sondern auch bestimmte Verhaltensweisen bei den Lernenden unterstützen. Lehrende müssen glaubwürdig und willensfest sein und ihr Unterricht muss faszinieren. [8] Lehrende müssen die Lernenden so ermutigen, dass sie tiefes Selbstvertrauen in die eigene Tüchtigkeit gewinnen. Das fördert die Ausdauer, die das Fremdsprachenlernen erfordert.

Schliesslich haben die Lernenden die schwere Aufgabe über den Wechsel der sozialen Organisationsformen zu entscheiden, so dass die Gruppenarbeit nicht scheitert und die Lernenden sich mit Erfolg konstant am Unterricht beteiligen.

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NATURE OF EFFORT’S SPECIFICITY IN THE DURING ATHLETIC TASKS

Ion LAZĂR¹

¹ Lect. univ., Ph.D. Lazăr Ion, “Mircea cel Bătrân” Naval Academy, Constanța

Abstract: *The batch exposed to scientific investigation is of 20 athletes, length jumpers, participants in the national Championship of athletics of România, which have been registered, measured and analyzed in competition, as well as in development training of muscular strength in which the athletes have used the means they commonly use, but also in means we imposed, like the condition simulator.*

Key word: *experiment, speed, training, method, jumping in lengths*

Hypotheses:

1. In every movement there is a special relation between the movement qualities in the competition situation that is different from the relation between the movement qualities used in the process of practice;
2. Between the relation speed-position during competition and the relation speed-position during practice there are major differences, not taken into account in jumping preparation in this moment, by specialists. The relation between strength-speed-position depends fundamentally of the neuromuscular control of the contraction;
3. Effort’s specificity during competition must reflect in the preparation means;
4. We try to point out differences between practice and competition by bringing in front the existence of the biomotor (non-metabolic) specificity of the competition, differences that are generating work, practice volume, with low premises of transfer in the specific movement of the competition;
5. The planned results’ dynamic and the effort’s specificity during competition are the ones that dictate preparation means efficiency and the entire practice process.

The methods and research techniques used were:

1. The method of bibliographic study;
 2. The observation method;
 3. Measurements and recordings method;
 4. Graphic method;
 5. Experimental method.
- Contributions to some major problems solving that condition the choosing of the most efficient means in practice;
 - Making specialists aware of the existence of a biomotor specificity that we call in the present paper non-metabolic, not with the intention to exclude the metabolic part of the phenomena but with the desire to point out

the existence of a specificity less present in the specialty literature;

- Identifying these elements that are in a permanent relation and that, after our opinion, will bring another way of approach of the specificity area, approach of which implementation in practice we hope to bring remarkable progresses through choosing the means and proper portioning and in concordance with the competition requirements and of perspective of sport tasks.
- Making athletes and coaches aware of the existence of some aspects which are related to the mean's efficiency growth of preparation by reference to the metabolic and non-metabolic sublayers of movement specificity;
- Redefining attempt of movement specificity.

Objectives:

1. Analysis and redefinition of effort's specificity concept in different tasks groups from athleticism with a larger approach in the case of jumping in lengths;
2. The identification of the main functional parameters and of the factors that determine movement qualities, effort's

The description of the pilot study's development and its conclusions

The pilot study was applied on a limited number of subjects, (5) athletes of the Naval Academy.

We mention that the same instruments were used, the same jumping sector and they tried as much as they could to make them at the same time of the day, but in different days. On images the angle between trunk and thigh was measured for the tap leg from the moment the foot made contact with the soil to execute the tap and until the moment in which the tap was considered finished.

Image analysis and data processing were made with the help of Dart Trainer program, respectively with the Analyzer module. For every jumper the angle between trunk and thigh, the angle evolution, watching the value of angular speed in different stages of take off, with respect to time, then the data were introduced in Excel where we obtain angular speeds. We mention that a reference point was taken -0- that was obtained from the measured angle difference from which 180 degrees were subtracted. I noticed that the values are negative when the angle between the trunk and thigh does not pass 180 degrees and become positive if this angle passes 180 degrees.

Athletes have been filmed with the purpose of analyzing and cinematic processing of the movement at a bell bar practice, where they made sit ups with the bell bar, making a number of 4 repetitions with the following weights: 40 kg, 50 kg, 60 kg, 70 kg, 80 kg, 90 kg, 100 kg. In this case we were concerned about finding out the angular speed value, the angle evolution between trunk and thigh. In image processing in order to calculate the angular speed we have chosen to measure from 40 to 40 milliseconds because there were portions where we had nothing to measure and we risked to introduce errors.

Also a condition simulator had been used that was adapted to the applied strength measurement in the raise from sit ups. At the made practice at the simulator with the help of video recording of the execution, we tried to find out the angular speed between trunk and thigh in the made sit up.

The interpretation of the values obtained in training versus competition

- Carefully studying the values of the parameters which interest us evidently, we observe that in sit ups with a bar bell training we have a larger time of motion which is found somewhere around the value of 0.56 seconds, and in competition we can talk about a time between the values of 0.12 s – 0.16 s.
- We observe a rate of angular velocity in training situated somewhere near 6 -7 rad/s much lower than the angular velocity obtained in competition, of value to about 13 – 13.5 rad/s.

Conclusions

energetic assurance systems, activity economy, stability and functional mobility of the nervous system;

3. The efficiency growth of the actions of choosing the used means in preparation depending on the structure information of the movement gesture.

The proposed tasks to be resolved were the following:

1. The study of the actual knowing level and research of the proposed theme
2. The study of coaches' methodic orientation in choosing the practice means with the purpose of developing the movement qualities favorable that assure performance progress;
3. Identifying and analyzing the less biological areas from the perspective of the effort's specificity (psycho-neuro-motor, command-effect relation, speedposition relation, angular velocity-time, etc.);
4. Establishing the schedule of the research development;
5. The making of the pilot experiment;
6. The making of the base experiment;
7. The interpretation of the obtained data.

In parallel with this acquisition, the results from the simulator delivered us data concerning the shown force by the athlete in the movement specific to the sit up with different level of break. The resulted data were represented by the force expressed in daN depending on the distance as height of the execution.

The data were picked up at an interval of 10 milliseconds. The pilot experiment was developed using a range of 5 types of brakes expressed in percentages, respective 20%, 40%, 60%, 80%, 100% from the break possibilities of the simulator.

After processing the video material from the made jumps during contests there resulted data that had been introduced in tables, in which columns we have the following parameters: time, angle -180 degrees (mathematic artifice that allowed us the angle transformation from grades to radians and the angular speed). As a consequence of the made applications presented earlier graphics had been made that show us differences in angle evolution in conformity with the time in the 2 situations chosen by us, respective practice and competition. From the graphics processing that we find in the paper but also in the annexes we observe differences between measured parameters values, materialized in the fact that during the competition it is worked in a smaller value of time and with a bigger angle from training.

In the relation angle – angular speed at the execution from practice versus competition we point out the fact that angle and angular speed values are superior during competition in comparison with the execution from training.

After the video analysis of the exercises made at the simulator, the data have been processed, introduced in tables, one table for every option of break.

And in this case the resulted data generated graphics that showed the relations angle-time, angular speed – time, angle – angular speed in the case of every option of break. Watching the speed zone in which work is being done we observe the fact, when the speed rises, the available of strength lower, speed lowers at the same time with the option break growth.

- There must not be neglected and therefore I underline the existence of a difference of amplitude between the exercises in competitions to those while in training.
- In the graphical analysis resulted from working on the recordings obtained while working with the condition simulator we saw strengthimprovement

- In the experiment we could state certain situations, which we understood better and have given us new openings for the realization of the experiment.

- The video recording technology was good, we have brought little corrections in positioning the camera, throughout the competition because initially we did not consider the spectator area which in our case were causing trouble.
- The video picture was taken in the case of jumping in length in competition at 30 cadres per second which has proven to be ineffective.
- In strength training, during the first filming we observed that the time base we had picked of 20 milliseconds it's ineffective, because there were portions where we didn't had what to measure images at 40 mls.

Results obtained in the wake of the experiment

For a correct representation of the results obtained we chose to do an average of the jumps in competition, in training and simulator, in each of the relations which have interested us. With the stating of the fact that, in the case of the simulator executions, we have 2 sets of graphics, one resulted from video analysis and another generated by the simulator. The averages have generated themselves graphics which point out relations between the following parameters: speed-time, angle-time, angular position-speed and the relations between force-position, force-speed.

The results put into light the existence of differences between the training executions and competitions from the speeds and positions point of view, the speed zones with which there has been work done in training versus competition as well as the differences of amplitude in which the executions are made in the two distinct situations.

Suggestions and recommendations

It is important to be known the internal traits of movement acts represented by the morphological sub-layer, bio-chemical functional and psycho-neuro-movement which can be different even in case in which the exterior characteristics of these movement acts are more or less close from a cinematic point of view.

1. Knowing these aspects, we will learn to choose the means most suited with the purpose of developing the movement qualities, placing the proper attention to the exterior characteristics as well as internal.
2. The spatial-temporal characteristics of the movement (technique), of the athletic probes impose a rigorous choosing of the training methods.
3. It must be took into consideration the fact that in every motion there is a special relation between the movement qualities in the competition situation which must be pretty close to the relation between the movement qualities utilized in the process of training.
4. The specificity of the competition effort must be reflected in the means of development of the movement qualities.
5. In developing the movement qualities there will be taken into account the competition conditioning- for example in developing the running speed of the jumper in length it will be considered the tapping threshold which is considered an obstacle for the athlete, making him modify his running speed.
6. In choosing the means of developing the movement qualities we will follow that these can be made with efforts that include the same segmentary muscular contraction regime required by the competition task.
7. There will be avoided the exercises that generate large volumes of work which do not find their competition echo.
8. The exercises and the dosage of these will be chosen after metabolic specificity and non-metabolic criteria of the competition characteristic effort, only in this way it will be attained a positive transfer of the accumulations of training in competition.
9. There must be major preoccupations of the coaches in making the training methods more effective and the entire training process and not ignore the fact that these are dictated by the dynamics of the planned results and specificity of the competition effort.

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NAVY SPEAK: ENHANCING YOUR UNDERSTANDING OF MARITIME TERMINOLOGY WITH THE HELP OF INTERCOMPREHENSION

Delia LUNGU¹
Maria Filomena CAPUCHO²
Mariana BOERU³

¹ Conf. univ. dr., Academia Navală „Mircea cel Bătrân”, Constanța, România;

² Prof.Ph.D, *Catholic University of Portugal*

³ Prof. def., Academia Navală „Mircea cel Bătrân”, Constanța, România.

Abstract: *This paper will attempt to illustrate the benefits of employing the intercomprehension method and techniques in order to enhance one's understanding of a specialized language, in our case, the maritime one. Although English is the “official” language of the naval environment, there is, however, a certain degree of multilingualism to be found especially aboard maritime ships with multinational crews. Therefore, a method such as intercomprehension, which increases the learners' awareness of the linguistic knowledge that they already possess and encourages them to actively transfer it to other foreign languages of interest, well, such a method will surely facilitate communication, especially in a multilingual environment.*

Keywords: *intercomprehension, ESP, navy*

Introduction

We are living in a multilingual European community, which is striving to maintain and promote its multilingual

nature. Moreover, our target student population is operating in a multiethnic and multilingual professional environment in which effective communication is essential to task

accomplishment. There is an obvious need for a link between language learning and intercultural learning. The multilingual intercomprehension opens the way for navy professionals from different countries to communicate on the same footing. Intercomprehension in its original understanding of two speakers communicating each in their native language is not

I. Intercomprehension and teaching ESP (Navy terminology)

Considering the multilingual and multicultural features of the global labor market today, it has become obvious that the way in which foreign language training has been done so far, its aims and methods need to be revisited and put into perspective so that they respond to the current challenges. This is where intercomprehension comes into place. Intercomprehension takes the current teaching practices and expands their reach into areas they have not really tackled before. Teaching a foreign language does not only imply the transfer of lexical and structural items or the correct pronunciation, but also the insight into another culture, the ability to communicate effectively beyond the written or spoken word. Moreover, the foreign language teacher's responsibility is to help the students develop their learning skills and strategies, which they have to be able to apply inside and outside the classroom, with or without the teacher's supervision. One might wonder where the novelty of such an approach lies. Student autonomy has been recognized as a key issue by ELT professionals for quite some time now. Well, this is true. However, while students have been expected to operate autonomously in *the* target foreign language, they have not really been encouraged to apply the same strategies to a second or third language they might wish to pursue. It is not that a miraculous set of procedures, which would ensure the rapid and efficient acquisition of different languages, has been suddenly discovered. It is merely the recognition of the potential of such learning strategies outside the boundaries of just one foreign language

Consequently, one of the first things we can do for our navy students is to recognize the need to capitalize on the foreign language knowledge they already possess. In doing so we would help them develop their skills not only to approach informational chunks in other, unknown languages, but also to autonomously acquire the specialized vocabulary in the language(s) they know,

Here are some practical examples of the ways in which intercomprehension could be used in our environment. Intercomprehension can be employed as a learning strategy developed while attending a foreign language course, concerning the acquisition of specialized vocabulary (in the

2. General intercomprehension skills

Besides teaching specialized vocabulary, intercomprehension can be used to develop the learners' multilingual receptive competence by means of a set of transfer-based deduction skills. Considering the natural capacity of human beings to learn foreign languages, it would be extremely beneficial if our students were made aware of the linguistic wealth they already possess and the ways in which they can use that to understand other languages. Thus, the foreign language teachers' responsibility should be:

- to motivate students to use intercomprehension by *making them aware of how much they already know*. Students might not even be conscious of the fact that their general knowledge of the world, their expertise in a particular field, their competence in their mother tongue as well as in a foreign language is part of their “fund of knowledge” which can be easily tapped when approaching other foreign languages.
- to develop the student's general linguistic competence. While teaching a foreign language, teachers should also *give their students information about language systems and language families*, thus developing their general language knowledge fund and enabling them to make correlations between languages more easily.

realistic and applicable in the naval environment. However, even limited passive knowledge of or receptive ability to decode some informational chunks in another language has the potential to strengthen professional relations by means of mutual respect for each other's cultural and linguistic identity.

foreign language taught, i.e. English, French or German) through the active and conscious use of intercomprehension strategies. These might include:

1.1 the awareness of internationalisms (especially well represented in technical language) of Latin and Greek origins or modern English. According to Peter Doyé “On average, adult Europeans have 4000 of these easily recognizable words at their disposal. They vary in amount and distribution from language to language, but even such languages as Finnish and Hungarian, which belong to the Uralian Group, contain quite a number of these international words.” [1] For example, all navy personnel will know what terms such as *GPS*, *radar* or *sonar* mean. Moreover, the very common word *anchor* comes from the Latin *ancora* or from or cognate with Greek *ankyra* which meant anchor, hook. In fact anchor is recognized as a very early borrowing and said to be the only Latin nautical term used in the Germanic languages [2].

1.2 the awareness of lexical similarities among languages, especially among those within the same family. Let us take for example the English word *buoy*. The Latin *boia* (*shackle*) was later found in Old French *boie* and Middle Dutch *boeie*. Today, the English *Buoy* is very similar to the Danish, *Bøje*, the Norwegian *Bøye*, the Swedish *Boj* or within the Romance family, the French *Bouée* and the Italian *Boa*.

Our students can make use of their knowledge of Romanian to deduce the meaning of specialized vocabulary in the other Romance languages. Mention must be made that Latin is taught in most Romanian high schools, functioning, therefore, as the perfect *langue dépôt* our students can use in their encounters with the other Romance lexical items. A very handy example would be the words *frigate* and *corvette*. Frigate was found in Middle French *frigate* and the even more accessible Italian *fregata*, spelt identically in Romanian. Originally it designated a small, swift vessel. Around 1636, *corvette* could be found in French, meaning “small, fast frigate,” which probably came from the Middle Dutch *korver* “pursuit ship,” and the German *korf* meaning both a kind of boat and a basket. Going back to Latin *corbita* (*navis*) meant “slow-sailing ship of burden,” from *corbis* which meant “basket.” As a curiosity, a basket was hoisted as a signal by Egyptian grain-ships.

- to help students *become aware of and actively use language learning strategies*. These deduction based strategies include the application of the students' knowledge of the world, of various cultures, of verbal and non-verbal communication patterns, of language systems and groups, of phonological patterns, and, last but not least, of morphology and syntax. It is vital that students, on one hand, should be made aware of these strategies when formally learning a foreign language, and, on the other hand, be encouraged to transfer them to any other foreign languages they are faced with.
- to raise awareness of and promote respect for cultural diversity through intercultural learning. Considering the fact that language is one of the most important carriers of culture, we feel it is essential that students *receive an intercultural education while learning a foreign language*. The more aware students become of cultural diversity and various cultural patterns, the more effective and affective communicators they become. In our particular case, since our students are expected to be functional in a multilingual, multiethnic professional environment, we feel that they need to be equipped with some general cultural competences in order to efficiently accomplish their tasks.

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A TWO-FOLD APPROACH TO DEVELOPING READING SKILLS: EXPLICIT VERSUS IMPLICIT VOCABULARY LEARNING STRATEGIES

Olesia LUPU¹
Elena COJOCARU²

¹ PhD Univ. Lecturer,

² Teaching Assistant Faculty of Economics and Business Administration, “Alexandru Ioan Cuza” University, Iași

Abstract: *The relationship between reading competence and vocabulary acquisition has been an on-going concern for recent ESP research. Nation suggests that ‘Learning rates can be increased considerably by some deliberate attention to vocabulary’ (2001), thus offering a theoretical grounding for developing explicit approaches to teaching vocabulary. The paper discusses implicit versus explicit strategies of teaching specialized vocabulary. The two approaches will be presented contrastively as to suggest that extensive exposure to new vocabulary helps learners acquire new vocabulary.*

Key words: *Vocabulary acquisition, reading competence, genre approach*

1. Reading Skills Definition and Typology

Whether we think of reading as an imperative for education or simply as a means relaxation, it is undeniable that it has an essential role in our lives. It is nevertheless a clear fact that reading is among the abilities which pave our way towards progress by providing us not only with new possibilities to communicate but, more importantly, with access to knowledge.

We strongly believe that the essential aspect which makes reading indispensable for most people is its educational dimension: as we have already shown, access to knowledge would be impossible in the absence of the ability to read. Therefore, in order to function successfully in the modern world, people must be good readers. Since education forms the foundation of any profession, we expect to read in academic contexts or in workplace environments as part of learning or engaging in our jobs.

We live in a globalized world where knowledge of our native language is insufficient for the purposes we need to achieve in both our personal and professional lives. Therefore, it is no longer enough to be a skilled reader in L1: reading in L2 becomes compulsory in order to ensure access to information and effective communication. We all want to become active participants in the society, to become aware of the changes taking place in the world we live in, to travel, to engage in advanced studies, to get a good job: all these could not be achieved without the ability to read. For millions of people, L2 reading skills represent a significant concern as these people negotiate careers and seek advancement in modern economies. [Grabe 7]

As William Grabe shows, there are three major sets of differences between L1 and L2 reading: *linguistic and processing differences, developmental and educational differences, socio-cultural and institutional differences*. As far as the *developmental and educational differences* are concerned, L2 readers who are engaged in academic learning have a very different store of L1 reading experiences that go beyond basic language processing; their reading abilities vary in terms of: identifying main ideas, drawing inferences as appropriate, connecting main ideas with supporting ideas, focusing selectively on key information, learning from new information presented in texts, integrating information across texts, evaluating information in relation to background knowledge and in relation to other texts. [Grabe 133-134] It is nevertheless clear that background information is essential to the way we first perceive and then understand, select information and interpret data whenever coming across a new text.

As we have already stated, establishing the purpose of our reading is essential: as Grabe demonstrates, *reading to learn* is normally carried out in academic and professional settings; this type of reading places more processing demands on the reader: he is expected to

remember the information he found in the text and, more importantly, to use it in the future; *reading to integrate information* requires that the reader synthesize information from multiple texts or bring together information from different parts of a long text; *reading to evaluate, critique, and use* information often represents an increased level of demand for readers are asked to evaluate and critique information from multiple texts, and, more importantly, to make decisions about which aspects of the text are most important, most persuasive and most controversial; and, finally, *reading for general comprehension*, which takes place when we read a good novel, an interesting newspaper story, a magazine to relax. Although it may appear as an easy task, *reading for comprehension* is far from this for it generally provides the foundation for other reading purposes, such as reading to learn and reading to evaluate. L2 readers normally find reading for comprehension much more difficult because of their lack of exposure to L2 print. [Grabe 10]

Therefore, it is quite clear that when we read a sign on the motorway our reasons are different from when we read a detective novel. Jeremy Harmer supports the idea that we can divide reasons for reading into two broad categories: *instrumental* – when a large amount of reading takes place because it will help us achieve some clear aim (e.g. we read a road sign so that we know where to go) – this type of reading takes place because we have some kind of utilitarian or instrumental purpose in mind, and *pleasurable* – people read magazines or newspapers, illustrated cartoons or photo-stories; the two types of reading do not, by any means, exclude each other: if we apply them to L2 students, we find that, most of the times, they combine successfully. [Harmer 200] However, as instructors we should always keep in mind the fact that L2 reading instruction should be sensitive to the students' needs and goals as well as to the larger institutional context. [Grabe 19]

Motivation and needs, therefore, are among the essential aspects which must be taken into consideration whenever dealing with L2 students. The instructor should be aware of their needs as well as of their expectations since fulfillment of these two ensures successful training. Foreign languages students normally need to achieve the ability to communicate in a variety of L2 contexts. This can be done by integrating reading, as an essential component, in the educational process. But how can we make them aware of the fact that reading can be used as an instrument for better communication? Research has demonstrated so far that if we consider the use of texts which are relevant not only in terms of information but also in terms of vocabulary, interest on behalf of our students can easily be stirred. Therefore, we can infer that reading is deeply connected to vocabulary: the first functions as a means while the latter serves as a relevant purpose and, at the same time, motivation for L2 learners.

2. The Learning Process and the Genre-Driven Approach

More recent research on vocabulary has identified a set of difficulties which are specific to L2 students: difficulty in understanding unknown vocabulary, difficulty in decoding complex sentences, reading too slowly because of word-by-word reading, lack of awareness of different types of academic texts, difficulty in identifying the main points of the text, lack of awareness of the purpose of reading, lack of flexibility in adjusting reading strategy to its purpose, lack of experience in recording key information. [Olwyn, Argent and Spencer 119]. Reading competence, thus, seen as a *complex cognitive process*, is an essential vehicle of vocabulary acquisition in the academic contexts. Learners are expected to read and use appropriate vocabulary as part of their learning. The main source of in-class vocabulary learning is that of reading various types of texts. As students are accustomed with reading genres such as literary texts, text book descriptions of a more general nature, they encounter difficulties in decoding new, unknown genres used in academic learning. Undergraduate students use a wide range of texts, starting with case studies, reference books, handouts of lecture notes, academic journals, and ending with company or government reports, guidebooks or manuals, edited collections of papers or conference reports. These new genres should be dealt with both in terms of content and communicative purpose.

3. Recent Vocabulary Research: Implicit versus Explicit Debate

Traditionally, language teaching strategies have incorporated recent research on vocabulary acquisition. Several studies have been designed in order to establish the nature of relationship between implicit and explicit acquisition of vocabulary. These studies seek answers to a set of research questions, such as: *How many words and which words do learners need to know?; How does L2 learners' vocabulary develop?; Why are some words more difficult to learn than others?; Is L2 vocabulary learned more easily through natural context or through direct instruction?; Which vocabulary learning strategies do students employ?; Which types of practice activities promote vocabulary learning?; What effect do certain types of marginal glosses and Internet annotations have on incidental vocabulary learning?; How does using a dictionary or one type of dictionary impact vocabulary acquisition?*

The answers provided by research focused on both implicit and explicit approaches to vocabulary acquisition emphasize that “structured presentation of material under implicit learning conditions has been shown to facilitate induction of the underlying rule system more effectively than random exposure” [N. Ellis 289]. The *structured presentation* has thus been integrated into languages activities built around explicit activities. These activities create a learning context which exposes learners to the same vocabulary several times before they start using it autonomously. According to Nation

Together with new genres students acquire new vocabulary which falls into three main categories: *technical*, *semi-technical* and *general academic* vocabulary. Nation states that technical vocabulary accounts for about five per cent of the words used in academic context. [Nation 5] *Technical vocabulary* is generally defined under headings, such as, new concepts and terms, whereas semi-technical vocabulary is assumed to be known and is not explicitly taught but expected to be noticed. Difficulties arise with words and phrases which have a restricted meaning in a particular discipline, or different meanings in different disciplines. The third category, *general academic vocabulary* represents a neutral, formal register. Various lists of academic words have been developed in the past twenty years. For instance, the corpus-based academic word list is comprised of words characteristic to academic texts and is used to construct a corpora for classroom use. More recently, Coxhead compiled an electronic corpora of 570 word families from disciplines of arts, commerce, law and science. A word family in this sense is a group of closely related words. These lists are very useful in identifying whether a text is academic or not. Therefore, a context-based approach to vocabulary learning aided by latest corpora is reported to be more effective in vocabulary acquisition. This approach involves choosing appropriate texts, examining their vocabulary, establishing its communicative purpose and only then selecting activities targeted at developing reading comprehension.

(2001), the three most important components of activities that foster L2 vocabulary acquisitions are: 1. **noticing**, which requires decontextualization where the word is temporarily removed from the context in which it occurred so that the learner can focus on the form and the meaning of the form; 2. **retrieval**, focusing on paraphrasing and multiple use of the same vocabulary; 3. **creative or generative use** of a word in a way that is different from the original context.

In opposition, implicit approach supports activities with less controlled activities. For instance, Clarke and Nation state that learners exposed to guessing meaning from context by *looking for context clues followed by dictionary work* may develop skills in automatic use of vocabulary. More recently, teaching methodology influenced by corpus-based research has favored a more balanced approach comprised of on-line resources and vocabulary software embedded into both structured and less structured activities.

By Way of Conclusion

In conclusion, reading in an academic context is part of a complex cognitive process targeted at developing both reading comprehension and vocabulary acquisition. Therefore, learners should be given in-class support for dealing with wider academic context where they need critical reading skills as to be aware of the status, purpose and significance of what they are reading. Moreover, the advances of informational technology will lead to computer-based language research, which will in the future go beyond the implicit-explicit approach to vocabulary acquisition.

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WHEN A SERGEANT BECOMES A BROWN HAT

Raluca-Aurora MATEȘ¹

¹ Asist. univ. dr, Academia Navală „Mircea cel Bătrân”, Constanța

Abstract: *Slang is the use of informal words and expressions to describe a person, an object or a condition. The definition of slang varies widely; however the generally accepted definition is of language which is very informal or much below the standard level of education. Slang is the continual and ever-changing use and definition of words in informal conversation, often using references as a means of comparison or showing likeness.*

Key words:

Slang refers to vocabulary that is meant to be interpreted quickly but not necessarily literally. It is notable for its liveliness, humor, emphasis, brevity, novelty, and exaggeration. Most slang is faddish and ephemeral, but some words are retained for long periods and eventually become part of the standard language (e.g., phony, blizzard, and movie).

Slang can be born from any number of situations or ideas (the word slang itself has come to represent selling, especially of illegal drugs). We should keep in mind that slang comes from areas dominated by adolescents and young generations (such as music scene, school scene, drug scene, sex scene, but also military life!)

Military slang consists in a wide range of colloquial terminology used commonly by military personnel. The majority of slang terms used in this field is quite unique because it originates in military acronyms or abbreviations, situations or ideas that are specific to this domain, or incorporates aspects of formal military concepts and terms.

Military slang is often used to reinforce or reflect in a friendly and humorous manner relationships between people in the armed forces, between soldiers and their equipment or soldiers in different combat or non-combat situations.

- 11 Bang-Bang, 11 Boom-Boom, 11 Bush — terms for MOS 11B, Infantry Rifleman.
- Baby G — A single star General; Brigadier-General
- Barracks Rat — someone who stays at the barracks and never goes out
- BB Stacker — soldiers involved with ordnance
- Bird Colonel — a full Colonel, from the eagle insignia of grade, to distinguish from the one-grade-lower Lieutenant Colonel, whose insignia is a silver leaf; also known as a “Full-Bird” Colonel, or simply, a “Full Bull”
- Black Diamond — a first sergeant, for the black diamond between the chevrons and rockers of subdued rank
- Black Hat/ Black Round — Airborne Instructor
- Bottlecap Colonel — a Lieutenant Colonel
- Brass/ Brass Hats — Colonels and Generals
- Brown Hat — Drill Sergeant
- Buck Sergeant — Sergeant (E-5)
- Butter Bar — a Second Lieutenant, as well as their rank insignia; from the appearance of the yellow rectangle of the rank
- Cherry — New recruit or private
- Chicken in a Frypan — a Specialist (E-4) rank insignia, which has an eagle inside a shield
- Chief — the unofficial form of address for any Warrant Officer (CW2 to CW5)
- Commo — The communications officer or soldier.
- Company-grade (officer) — the ranks of Second Lieutenant, First Lieutenant, and Captain
- Cookie — Mess Sergeant
- CWO — Chief Warrant Officer grade 3 and 4.
- DICK — Stands for Dedicated Infantry Combat Killer (Used more in basic training)
- Dirt Dart — U.S. Army Airborne terminology for a jumper who has lost control or functions of his or her parachute
- Doc — a term of respect for medical professionals; generally used for medics, it also applies to actual doctors and (rarely) physician’s assistants
- Down range — at an FOB or out in the field. See Desert Fox
- Drill — Drill Sergeant
- Fast Tracker — Term used for soldiers who ascend rank/pay grades unusually quick. Can be a negative term

used to denote inexperience related to leadership roles of non-commissioned officers.

- Field-grade (officer) — the ranks of Major, Lieutenant Colonel, and Colonel
- First Daddy — First Sergeant
- First Lieutenant, Second Award — a Captain, so named because the insignia of grade consists of two parallel silver bars
- First Shirt — First Sergeant
- Full Bull — Bird Colonel
- Full-Bird Colonel — Bird Colonel
- Fur Sausage — First Sergeant (British Mispronunciation)
- Green Beret — United States Army Special Forces Soldier, so known because of their distinctive head gear.
- Ground-Pounder/ Grunt — Infantryman; historically associated with the sound a soldier makes when shouldering his field pack. Alternatively associated with a supposed Vietnam-era acronym for hastily assembled recruits and reinforcements, “Ground Reinforcements UNTrained.” Grunts takes immense pride in the nickname. To non-infantrymen, grunts are often referred to as “crunchies,” “nugs,” or “ground-pounders.” The last three are never used self-referentially by grunts.
- Gun Bunny — Artilleryman
- Hard Stripes — used to describe Corporal (CPL) stripes
- Joe — 1) Generalized term for any or all soldiers. 2) In basic training, an incompetent or clueless recruit.
- Leg — U.S. Army Airborne term for any service member without jump status.
- Lifer — career military person
- Light Colonel — Lieutenant Colonel; see also Bottlecap Colonel, contrast with Bird Colonel
- Mosquito Wings — E-2 rank insignia (one chevron, looks like a ^)
- Motorized Pogue — Military Police
- Mud Puppy — military policemen
- New Boots — Term used when referring to new soldiers fresh from training, denoted by their newly issued, unscuffed boots.
- Old Man — Company Commander
- Platoon Daddy — refers to the Platoon Sergeant, who is the lead NCO in a platoon
- Private Major — Private or Specialist who tries to act with authority they do not have
- Private No Rank — an E-1 private, who has yet to earn a rank insignia.
- Ring-Knocker — a West Point graduate, from the large class ring that many wear.
- Round Brown — a Drill Sergeant, or his/her hat.
- Sergeant Major — the First Sergeant’s wife or an E-9 staff position
- Shadow Clerk — a non-clerk serving unofficially as a company clerk
- Short Colonel — older reference to a Lieutenant Colonel
- Short/Short-Timer — soon to be released from service; usually 90 days or less; i.e., a “two-digit midget”
- Shower Shoes — 1) soldiers who have just come to the forward unit from basic training; 2) flip-flops
- SIGO — Signal Officer.
- Slick Sleeve — Soldier with no combat patch.
- Smaj — Sergeant Major
- Smoke — Platoon Sergeant (Artillery)
- Smokey the Bear – a term for a drill sergeant based on their hat
- Sparky — radio operator
- Spoon — cook

- Telephone Colonel - based on the practice of Lt Colonels answering the phone as “Colonel Smith” or “Colonel Jones”
- Top — A First Sergeant (E-8), who is the top ranking NCO in a company size unit.
- Top Kick — First Sergeant
- Train Tracks — Captain’s rank insignia (it looks like two pieces of railroad track)
- Trigger Puller — an infantry or special operations soldier who sees combat often.
- Trooper(s) — used in lieu of “soldier” when referring to Airborne soldiers or Cavalrymen
- Turtle-Head — new recruit; still in training
- Turtle-Shell — a recruit in basic training who has not qualified with their weapon yet. This refers to troops being able to put on the camo cover for their helmets after they qualify and the turtle-shell like appearance of the helmet without the cover.

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PUSHUPS VARIATIONS, MODIFICATIONS AND MISTAKES

Cristian Ovidiu MIHĂILESCU¹

¹ Lecturer Ph.D. Naval Academy “Mircea cel Bătrân” Constanța, Romania

Abstract: The article is an essay about pushups which explains step by step how these should be performed, in a correct manner, what are the possible variations and how should we avoid possible mistakes, preventing thus injuries. The article seek for instructing all (beginners, intermediates and advanced) athletes in how to introduce the pushups in their workout in order to build strength and endurance in upper body.

Key words: *Pushups, workout, strength, muscle, endurance, chest, shoulders, arms, core.*

Introduction

Pushups are a powerful total body exercise, building strength and endurance in the chest, shoulders and arms, with the core and lower body acting as stabilizers. Pushups are a favorite go-to exercise, whether you are traveling with no equipment or want an exercise that will fire your muscle fibers, pump blood to your muscles and prepare you for the workout to come. They can be an important part of any strength training routine because they work multiple muscle groups, giving you more out of your training in less time. Even better, there are so many variations that almost anyone, from beginner to advanced exercisers, can find a version that works for them.

Step by Step: Pushups

- a. Begin on your hands and knees, placing your hands on the floor about shoulder-width apart, palms flat.
- b. Extend the legs straight, resting on your toes. Make sure your hands are directly under the shoulders (not forward).
- c. Brace your abs and legs to stiffen the torso and keep the neck in neutral alignment so that your body is in a straight line from the top of your head to your heels.
- d. Bend the elbows, allowing them to flare naturally out to the sides, and lower your body until the nose touches the floor. Keep your torso rigid and avoid sagging in the middle or piking the hips up.
- e. Push into the floor to push yourself back to starting position, continuing to keep the torso and legs braced. Push all the way up, but don't lock the elbows at the top of the movement.
- f. Continue moving up and down in a flowing motion, avoiding pausing at the top of the movement.
- g. If you are not able to do the move without lifting the hips or sagging through the middle, try a modification and slowly work your way up to traditional pushups.

Adding variety to your pushups will help you engage the chest, shoulders, arms and core in different ways and add a new dimension to your training. Below are a few new ideas for how to vary your pushups:

- **Change Your Hand Position** - A narrow grip pushup (hands about 5-8 cm apart) will engage more of the triceps while a wide grip pushup (hands wider than the shoulders) will emphasize the outer part of the chest.
- **Pushup on the Ball**- A ball can provide extra support if you keep it positioned under the thighs or add intensity if you roll all the way out on your toes.

Content

While pushups are an excellent exercise, it is easy to make mistakes and put your body at risk for injury and pain by doing them incorrectly. Pushups require a good deal of upper body strength as well as a very strong core to brace your body as you move up and down. If you are new to pushups, you may need to start with a modification to build strength and endurance and practice your form.

This step by step article explains everything you need to know about pushups: How to do them correctly, variations, modifications, alternatives and mistakes that can put added stress on your body.

In step one, we focus on traditional pushups.

- **Pushups – Hands on the Ball** - This advanced exercise will likely make your arms shake to keep your body in good alignment. Take extra care with this one.
- **Decline Pushups** - Elevating the feet on a step or platform shifts your center of gravity and places emphasis to the upper chest.
- **Incline Pushups** - Elevating the hands shifts your center of gravity, placing the emphasis on the lower part of the chest and reducing the percentage of body weight you're lifting.
- **Staggered Pushups** - By staggering your hands, you increase the load on one arm, which adds intensity.
- **Pushups with Med Ball Rolls** - Elevating one hand on a medicine ball adds intensity, and rolling the ball from hand to hand engages the abs, adding a dynamic element.
- **Dive-bomber Pushups** - These are intense and challenging, requiring tremendous shoulder and core strength as you dip down and up for a dynamic pushup.
- **Pushups with Side Plank** - These pushups involve a rotation into a side plank, emphasizing the core.
- **Resisted Pushups** - Adding a resistance band will increase the tension during the both phases of the movement.
- **Pushups on the BOSU Balance Trainer** - Elevating the feet on the unstable surface of the dome will challenge your strength as well as your balance and stability.
- **Moving Pushups** - Try a regular pushup with one hand on a paper plate and then walk the hands to the side so that the other hand is on the plate for another pushup.
- **Med Ball Pushups** - Holding onto a medicine ball will challenge your stability and engage the triceps.
- **Seesaw Pushups on the Ball** - This pushup emphasizes the triceps along with the chest.

- One-Arm Triceps Pushup - This targeted exercise

challenges the triceps along with the core.

Adding Pushups to Your Workouts

If you are an intermediate or advanced exerciser, choose 1 to 3 different pushups (such as a regular pushup, a staggered pushup and a decline pushup), performing each for 1 to 3 sets of 10 to 16 reps. If you are a beginner, start with one exercise (such as modified pushups or wall pushups) and do 1 to 2 sets of 10 to 16 reps. Pushups are great at the beginning of your chest or upper body workout to warm up the muscles and get the blood pumping.

If you have not done pushups before, or it's been a long time, you may want to start with a modification that will allow you to practice the movement, build strength and keep your body safe. Keep in mind that even modifications may not work for everyone. If you feel pain, skip the exercise and substitute a different version or try one of the alternatives listed below.

Avoiding Wrist Pain

One common problem exercisers may experience during pushups is wrist pain. If you already having problems with your wrists (such as carpal tunnel syndrome), pushups may aggravate the problem. If you find this is a problem, try these tips for avoiding wrist pain:

- **Distribute your weight evenly:** During pushups, try distributing your weight evenly across your entire hand rather than on the heel of your hand.
- **Use dumbbells or pushup bars:** Holding dumbbells or using pushup bars may allow you to keep your wrists straight during your pushups.
- **Use your knuckles:** Another option is to do the pushups on your knuckles. Make a fist and rest your hands on your

Bracing Your Core

To practice bracing your core and make sure you have the strength to hold your torso stiff for pushups, start with a modified plank exercise. Begin on the elbows and knees, dropping the hips down so that you're in a straight line from the head to the knees. Pull the abs tight to hold your torso stiff, eyes looking naturally forward. Try to do this move in front of a mirror to make sure your hips aren't too high (i.e., as in an all-fours position).

If you can handle the modified plank while bracing the abs, do the same move on your hands instead of your elbows. Again, make sure your torso is stiff and your body is in a straight line.

If you can master that, try moving through a pushup on the knees, making sure you keep the torso stiff. If you find you're letting go at the bottom of the movement, practice your plank exercises, holding each one for 20-60 seconds at a time to build more endurance and strength. You can also go back to an easier modification until you're able to progress.

Other common pushup mistakes involve leading with the chin or dropping the head, both of which take the neck out of neutral alignment and, thus, compromise your form. It's easy to lose track of your head position when you're

Other Common Pushup Mistakes

Aside from the more common form mistakes, there are a few other things to watch out for:

- **Faulty hand position:** There are a number of ways to position the hands during pushups; normal grip, wide grip, narrow grip, staggered grip, etc. One common mistake, however, is placing the hands too far forward, which may stress the shoulders. Whatever grip you choose, make sure your hands are positioned at the same level as the shoulders and chest rather than under the neck or chin.
- **Lowering halfway down:** If you find a pushup difficult, one common response is to avoid going all the way down. Changing your range of motion at times can be a

Conclusions

Pushups are the most used exercises which strengthen the entire body, building endurance and strength especially on chest, shoulders, and arms. Pushups are also important for developing a stronger core and lower body by

activating stabilizer muscles. They can be an important part of any strength training routine or they can constitute a full body training alone. Although the pushups may seem an easy thing to do, everyone must be careful especially in

- Wall or Pushups - Floor pushups require you to lift a larger percentage of your body weight than wall pushups, which allow you to practice your form without straining through the torso. You can also try these on a stair rail or other raised surface to reduce the amount of body weight you're lifting.
- Modified Incline Pushups - When you've mastered wall pushups, add intensity by trying a modified incline pushup, with the upper body elevated on a step or platform.
- Pushups on Your Knees - Taking modified pushups to the floor adds intensity and challenge. Without the elevation, your upper body and core will have to work a little harder.
- BOSU Pushups - If you want more of a challenge, using a BOSU will add instability to the movement, requiring your core and stabilizer muscles to kick into high gear.

knuckles. Make sure you use a comfortable, cushioned surface and, obviously, avoid this one if it's painful.

- **Brace your core:** You can also take some of the weight off your hands (and protect your lower back) by drawing the abs in and keeping your core braced and stiff throughout the movement. If you're not able to do that, move to an easier variation.

The most common problem I see with pushups is sagging in the middle or not properly bracing the core and keeping the torso stiff throughout the movement. Pushups require a fair amount of strength in the abs and back and letting go through the middle can cause back pain and, of course, bad form.

focusing on so many other things, particularly when you get fatigued. Your goal should be to use perfect form for every pushup. As soon as any part of your body fails, it's time to rest or move to an easier modification.

Perfect pushup form involves keeping the head in neutral alignment with the body. That means you want the top of your head to point to the opposite wall, eyes on the floor. If you can see your toes or the wall in front of you, your head is out of alignment.

Another mistake we sometimes make during pushups is locking the elbows at the top of the movement. Most of us do this when we get tired and, desperate for a break, we lock the joints, which offers a little breather. Unfortunately, it's never a good idea to lock the joints during any exercise, since that can put too much stress on the joints and potentially cause pain and injury.

During pushups, locking the elbows may give you a brief rest, but it also takes the stress off your muscles and puts it on your elbow joints. You can avoid this by, first, keeping a very slight bend in the elbows at the top of the movement. Second, keep the pushups slow, controlled and flowing from one rep to the next. If you're too fatigued to avoid locking the elbows, take a break or try an easier modification.

positive thing but, if all of your pushups involve only half of the movement, move to an easier version that allows you to go all the way down and all the way back up.

- **Rolling on the ball:** When doing pushups with the lower body propped on a ball, it's easy to let the ball roll forward or back to 'help' you during your pushup. Use your core and legs to brace your body on the ball so that, as you move up and down, the ball doesn't move.
- **All of the above:** When fatigue is high, you may find your body failing in multiple areas -- sagging torso, dropped head, locking elbows and stopping the movement halfway down. Remember that stopping early, or switching to an easier version, is better than continuing with bad form.

activating stabilizer muscles. They can be an important part of any strength training routine or they can constitute a full body training alone. Although the pushups may seem an easy thing to do, everyone must be careful especially in

properly **bracing the core** and keeping the torso stiff throughout the exercise in order to avoid injuries.

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COMMENT PEUT-ON MOTIVER LES ELEVES ET LES INCITER A APPRENDRE LES LANGUES ETRANGERES?

Andreea-Simona MILAN¹

Résumé: *Aujourd'hui, on attache plus d'importance à l'apprentissage des langues à l'école. L'enseignant a un rôle important dans l'apprentissage d'une langue étrangère. C'est à lui de savoir comment faire pour attirer ses élèves, de choisir les bons instruments de travail pour la classe de langue et de garantir le succès des élèves.*

Mots clé: *motivation, attitude, initiation*

Pour la société au sens large, l'enseignement des langues permet aux apprenants de comprendre et de se faire comprendre. Comme enseignant de langues, on souhaite que nos élèves acquièrent des connaissances solides, non seulement apprendre à “se débrouiller”. Actuellement, dans plusieurs pays, au moins la moitié des élèves de l'enseignement primaire apprennent une langue étrangère. Chez nous, en Roumanie, les élèves de collège apprennent même une deuxième langue étrangère.

C'est plus facile à apprendre une nouvelle langue pour ceux qui pratiquent déjà une. L'apprentissage des langues dès le plus jeune âge n'est profitable que lorsque les enseignants ont été spécialement formés à l'enseignement des langues à de très jeunes enfants, que le nombre d'élèves par classe est suffisamment faible, que le matériel pédagogique adapté est disponible et que le programme scolaire prévoit une plage horaire suffisante pour les langues.

Des études ont montré que les enfants qui apprennent une langue étrangère développent des qualifications intellectuelles dans d'autres domaines. Par exemple, un chercheur a constaté que les étudiants qui avaient appris correctement une langue étrangère au lycée ont eu une moyenne supérieure dans tous les sujets de lycée.

Nous trouvons que la motivation des enfants/élèves dans l'apprentissage des langues étrangères est très importante. Tout enseignant a le souci de donner le goût de l'apprentissage d'une langue étrangère à son public. Le plus souvent l'enseignant tient compte de l'âge auquel l'apprenant commence l'apprentissage de la langue étrangère, de l'environnement linguistique et culturel de l'apprenant et le statut de la langue maternelle, de l'attitude de l'apprenant vis-à-vis de l'école en général et du niveau éducatif de ses parents.

Dans la situation d'enseignement d'une langue étrangère on tient compte de la façon dont l'élève a abordé la langue au début et de la personnalité des enseignants. L'attitude positive manifestée par l'enseignant fait que l'enfant se met à obtenir de bons résultats. L'affectivité occupe une place à part dans l'enseignement des langues chez les petits, vu qu'on enseigne parfois les langues étrangères à la maternelle. Il s'agit donc de motiver les enfants à apprendre une langue étrangère dès le plus jeune âge. Plus l'apprentissage sera précoce, mieux ce sera pour l'enfant.

L'enseignant doit être vigilant, étant donné que l'initiation à une langue pourra réveiller des frustrations vécues auparavant; l'enseignement devra véritablement être centré sur le jeune apprenant, qui se découvre pas à pas, et est tout de même un jeune être fragile.

À cet âge, le jeune enfant peut se projeter dans le temps et dans l'espace par la pensée; il est donc important de mettre en oeuvre des activités qui reposent sur le

raisonnement et l'anticipation. Il sera ainsi amené à restructurer le réel et notamment à apprendre à nommer les choses; il apprendra également à reconstruire son temps et son espace (grâce à des gestes et des mimiques). L'enfant est en plein développement et a un besoin primordial de mouvement, d'activité et d'expression. Il est important de respecter ses rythmes et de ne pas brûler les étapes dans cet apprentissage. Il faut lui laisser le temps d'apprendre.

Ce que l'enseignant fait en classe, par son attitude, par sa manière d'être, par les activités choisies pour travailler avec les élèves, prend une importance capitale pour l'ouverture d'esprit et le goût de la recherche des apprenants.

On se pose la question suivante: l'élève est-il assez motivé pour apprendre une langue étrangère? La motivation est primordiale. Si pour bien danser il faut aimer la musique que l'on danse, pour bien parler il faut aimer la langue que l'on veut parler.

Il est nécessaire de donner confiance aux apprenants, enseigner aux enfants à communiquer avec tous les langages qu'ils ont à leur disposition (mime, gestes, mots clé, dessins). Si on travaille le maximum avec ce qui est déjà acquis, les enfants réussissent très bien à utiliser le peu qu'ils savent dans des situations diverses.

Des études ont montré qu'il n'existe pas “une méthode” et qu'il n'y aura jamais de “méthode idéale” pour enseigner les langues étrangères mais, par contre, qu'il existe des enfants avec leurs besoins, leur personnalité à construire, et que, donc c'est l'enfant qui doit être le protagoniste de son évolution avec l'aide d'un adulte. L'enseignant peut aider les enfants à apprendre une langue étrangère de différentes manières:

- développer chez les enfants la prise de conscience qu'il existe d'autres langues que celle dont ils sont familiers et éveiller leur intérêt pour ces langues,
- susciter leur activité pour les écouter, pour y repérer des éléments immédiatement abordables, pour s'en emparer et s'approprier ces premiers éléments de connaissances, pour les transformer en savoir faire nouveaux, modestes, certes, mais gratifiants,
- les conduire à constater qu'ils y réussissent et y prennent plaisir,
- susciter ainsi le désir d'aller plus loin.

Les élèves peuvent garder la motivation pour apprendre une langue étrangère s'ils ont un objectif précis ou bien, s'ils familiarisent avec la culture sous-jacente à la langue. Les langues n'existent pas pour elles-mêmes. Derrière elles se cachent une culture, et chacune d'entre elles est, d'une manière ou d'une autre, fascinante. On peut être satisfait de connaître une langue étrangère, mais on l'est encore plus quand elle nous permet d'apprendre la vie qui se cache derrière elle.

La façon la plus avantageuse de profiter de l'apprentissage d'une langue étrangère est de pouvoir l'exercer dans le pays où elle est parlée.

Il ne faut pas se borner aux méthodes des manuels, et trouver des choses pour être motivé à apprendre. Apprendre une autre langue à l'aide de la musique étrangère est très probablement parmi les exercices les plus

formateurs. Il suffit d'étudier de près les paroles pour savoir ce que l'on entend, et apprendre à les reconnaître en écoutant les chansons; c'est un excellent exercice pour faire travailler son oreille.

On apprécie toujours mieux les choses quand on les fait bien. Apprendre correctement une langue sera mieux pour tout le monde.

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ELITE OF ROMANIAN NAVY DIPLOMACY – COMMANDERS OF NAVY SCHOOL “MIRCEA” (1939-2009)

Marian MOȘNEAGU¹

¹ Captain (N.), Ph.D, Chief of Military Historical Service

Abstract: *The artisans of these diplomatic effects were the commanders of the School-Ship “Mircea”, part of the gallery being Captain August G.T. Roman (16 January 1939-1st April 1941), Captain Gheorghe Gustav Drimba (1st April 1941-1st October 1943 and 2-5 September 1944), Lieutenant Constantin Chiriac (1st October 1943-2nd September 1944), Captain Iosif Biaciu (9 September 1947-15 May 1948), Lieutenant-captain Ioan Stoian (27 May 1946-9 September 1947), Captain Nicolae Milu (May 1948-June 1949, June 1950-June 1951), Captain Ioan Gheorghe (May 1952-30 September 1955), Lieutenant-captain Vladimir Cosmiceanu (30 September 1955-1960), Lieutenant Costică Ciocoiu (1960-1962), Captain Alexandru Hârjan (1st January 1965-19 September 1973), Captain Petre Zamfir (5 April 1965-25 February 1966, was in command of the ship only during the Constanța-Hamburg march), Captain Eugen Ispas (19 September 1973-8 September 1977), Captain Dan I. Stăiculescu (15 August 1978-5 March 1990), Captain Dinu Sorin Pampărău-Sălăvăstru (5 March 1990–2006) and Captain Gabriel Moise (1 October 2006 till present).*

Key words: *commanders, School-Ship “Mircea”*

Besides fulfilling the specific missions to train the cadets of the Navy Academy “Mircea cel Bătrân” and of the Army Apprentice Military School “Admiral Murgescu”, the School-Ship “Mircea” in its 70 years of activity had traditional missions to promote the national prestige and to create a favorable image of Romanian Navy Forces abroad.

In this context, the training marches conducted between 1939 and 2009 had an important role, as well as the stops in foreign ports, the protocol visits, the navy ceremonies and not least, the dress and the conduct of the crew.

The artisans of these diplomatic effects were the commanders of the School-Ship “Mircea”, part of the gallery being Captain August G.T. Roman (16 January 1939-1st April 1941), Captain Gheorghe Gustav Drimba (1st April 1941-1st October 1943 and 2-5 September 1944), Lieutenant Constantin Chiriac (1st October 1943-2nd September 1944), Captain Iosif Biaciu (9 September 1947-15 May 1948), Lieutenant-captain Ioan Stoian (27 May 1946-9 September 1947), Captain Nicolae Milu (May 1948-June 1949, June 1950-June 1951), Captain Ioan Gheorghe (May 1952-30 September 1955), Lieutenant-captain Vladimir Cosmiceanu (30 September 1955-1960), Lieutenant Costică Ciocoiu (1960-1962), Captain Alexandru Hârjan (1st January 1965-19 September 1973), Captain Petre Zamfir (5 April 1965-25 February 1966, was in command of the ship only during the Constanța-Hamburg march), Captain Eugen Ispas (19 September 1973-8 September 1977), Captain Dan I. Stăiculescu (15 August 1978-5 March 1990), Captain Dinu Sorin Pampărău-Sălăvăstru (5 March 1990–2006) and Captain Gabriel Moise (1 October 2006 till present).

Next, we will present the main steps in their career as commanders of the School-Ship “Mircea”, as well as other positions that they occupied in the Romanian Military Navy Learning system.

Rear Admiral August T. Roman was born on 10th August 1892, at Buzău. He graduated the primary and secondary school in his hometown, the Navy Academy from Livorno «1911-1914, during the Italian-Turkish War (29 September 1911-18 October 1912) he participated actively being abroad in the Italian Military Navy», Application Navy School and Information Course for Senior Officers (1923-1924), War Navy School from Paris (1st November 1925-1st

November 1926) and he conducted training on a German ship with sails “A.L. Schlagheter” (1st November-20 December 1938).

He participated at the reception of the School-Ship “Mircea”. “With a small crew, after preparing, he left with the ship towards the country, where he arrived in perfect conditions, after a long journey made with personnel not enough trained. Thanks to his exceptional qualities as sailor, service man and instructor, he conducted the first training journey with the students of Navy School in the Mediterranean Sea having remarkable results”, mentioned Vice Admiral Petre Bărbuneanu.

Rear Admiral Gheorghe G. Drimba was born on 27 April 1905, at Cohaliu, village Rupea, Târnava Mare, today district Brașov.

He graduated the High School (1923), Bucharest Polytechnic (3 years, 1926), Navy School, Preparatory Department (1928, with the mark 7,40, the fourth from 19 students), Navy Special School (1930, with mark 7,45) and Military Institute of Physical Education (1933).

As an officer with the Sailing, he was a part of the first crew that brought, in 1939, the School-Ship “Mircea” in the country. He became mate, after Captain August Roman left, and between 1941 and 1944 he commanded the sailing ship of Romanian Navy Forces, and in 1941 he sheltered it on Măcin Channel.

Captain Constantin Chiriac was born on 22nd February 1914, at Bunești, Huși, district Iași.

He graduated primary school (1925), High School Huși (1928), Military High School Dealu Târgoviște Monastery (1930), Military High School „General Gheorghe Macarovic” Iași (1933), Navy School (1936), Special Navy School (1938) and Faculty of Mathematics and Physics from “C.I. Parhon” University Bucharest (1958).

He was the commander of School-Ship “Mircea” (25 October 1942-20 April 1944), commander of School-Ship “Liberty” and yacht “Sunrise” (30 December 1947-6 June 1949), study director at the Navy Officers School (June 1949-July 1951), educational deputy head of Navy Military School (July 1951-December 1952), chief of Education Department of Navy Officers Military School (December 1952-January 1954), chief professor at Navy Officers Military School

(January-December 1954), deputy head of Department Higher Mathematics and Theoretical Mechanics at Superior Military Navy School (December 1954-October 1957), deputy head of Department Mathematics and Physics at Superior Military Navy School (October 1957-June 1958), senior lecturer at the Department of Superior Mathematics, Physics and Foreign Languages (June 1958-March 1959), deputy head of Department Superior Mathematics and Foreign Languages (November 1959-October 1964) and deputy head of Department of Mathematics at the Superior Navy School (October 1964-17 September 1966).

In 1932 he published at Iași the mathematics brochure “Equations Equivalence” and between 1932 and 1949 he published articles and reviews in “Mathematics Magazine” at Timișoara and Bucharest. Also, together with Captain Eugene Bălăbănescu drafted and published in 1964 the course of “Spherical trigonometry with applications in navigation”.

Captain Iosif S. Biaciu was born on 22nd January 1910, at Rogova, district Mehedinți. On 15 October 1930 he graduated Navy School.

He worked as a noncommissioned officer and officer on board of N.M.S. “Mircea” (1st November 1939-1st April 1940), officer on board of N.M.S. “Mircea” (22nd July 1941-1st April 1942) and commander of School-Ship “Mircea” (9 September 1947-15 May 1948).

Captain Ion Stoian was born on 6 August 1907, at Feldioara, district Brașov.

He graduated Navy School (1929), Application Navy School (1929), Superior War School (1942) and the Training Course for Sailing Ships in Germany.

He activated as a Sailing and Maneuver Ship professor at Navy School (1st April 1935-1st October 1937), Navy School (1st April 1939-1st April 1942), commander of School-Ship “Mircea” (27 May 1946-9 February 1947, 15 May-16 November 1949) and superior commander of Military Navy Schools (9 February 1947-20 November 1948).

As a commander of School-Ship “Mircea” he conducted two instruction campaigns on the sea.

After he retired, he activated in sails shipping sports domain.

Captain Neculae I. Milu was born on 3rd February 1915, at Trăisteni-Teșila/now Valea Doftanei, district Prahova.

He graduated primary school at Trăisteni (1928), the first and second class courses at High School „Ioan Meșota” from Brașov (1930), troop child at 2nd Mountain Battalion, 3rd to 8th classes at Military High School “King Ferdinand” from Chișinău (1936), Preparatory School for Officers Bucharest (1937), School-Ship “Mircea” (1st July 1939), Application School Constanța (18 April 1941) and Torpedo Boat Officer Course Constanța (1942).

He was the commander of School-Ship “Mircea” (May 1948-June 1949, June 1950-June 1951), of School-Ship “Liberty” (June 1949-January 1950) and commander by overlapping of 514 Detachment School-Ships (June 1951-October 1952). In 1951 and 1953 he entered with School-Ship “Mircea” in Burgas and Varna ports to shelter against storm.

Between April-October 1954 he administered the command of 514 Detachment School-Ships, in October 1955 being named commander of Superior Military Navy School Constanța. “From 30 October 1955 till present (22nd August 1957 – n.n.) he was chief of superior Navy School. In this position he obtained good results.

He was moved to school to put order and create discipline necessary to such an institution. He succeeded to rise the order, discipline and education in the Superior School to the level requested.

He is an officer with a lot of working power. He has a navy training and a practical one with ships. He knows well and applies the military regulations. He respects the principles in the relations with inferiors and superiors.

He has initiative and organizing spirit. He works operatively.

He knows the battle preparing and education problems and has experience in this field.

He studies for raising his ideological level. He is demanding, energetic, calm and good sailor.

In conclusion, rank I captain Milu Nicolae is an officer well trained from all points of view, with a long practice with ships and M.U. and he knows well the battle preparing and education problems from F.M.M.

I propose him to be named deputy head for battle preparing and education of C.F.M.M”, recommended commander of Military Navy Forces, Gheorghe Sandu.

“The officer was suited to occupy the position of chief of Superior Military Navy School.

Under his conduct the school obtained good results at education, discipline and order.

He is a good sailor, he has a beautiful navy and general education, and he is well trained from the political-ideological point of view.

He is a good organizer, has a manager capacity, he is disciplined and demanding.

He knows and applies well the regulations, he has working power and loves sport, and he is an officer with authority in navy. [...] In conclusion, he is a good navy officer, good organizer and with management capacity. [...] I propose him to be named chief of Constanța Base”, concluded the characterization at the end of 1958 the commander of Military Navy Forces.

Captain Ioan Gh. Gheorghe was born on 30 January 1922, at Galați.

He graduated High School “Mircea cel Bătrân” Constanța, Military High School “King Ferdinand” Chișinău, Military High School “Mihai Viteazul” Târgu-Mureș (1940), Navy School N.M.S. “Mircea” (1942) and Application School Turnu-Măgurele (1946).

In 1951 he was named commander of School-Ship “Liberty”, and in 1952 the commander of Detachment of School-Ships.

Between 1954 and 1955 he was the commander of School-Ship “Mircea”, with which he faced two storms on the Black Sea.

Lieutenant-captain Cosmiceanu T. Vladimir was born on 2nd August 1920 at Soloneți, district Soroca, now Moldova Republic.

He graduated primary school at Soloneți, district Soroca (1934), Arts and Vocational School, transformed in Industrial Gymnasium at Ghermești de Sus, district Soroca (1938), Political Officers Short Course Breaza (May 1949), Military Training Short Course (June 1949), Navy Training Course with the duration of 8 months at board of School-Ship “Mircea” (1950) and Ship Commanders Course (1951).

He was the commander of School-Ship “Liberty” (15 December 1952-1955) and commander of School-Ship “Mircea” (30 September 1955-1st April 1960).

Captain Costică I. Ciocoiu was born on 1st January 1933, at Andrieșești, Hemeiuiși, district Bacău.

He graduated primary school in his village (1944), Arts and Vocational School Bacău (1948), Boys Industrial High School Bacău, transformed in Middle School Technology Agriculture Mechanization (1953), Superior Military Navy School, Artillery Faculty (1957), Chief of Staff Course (1971) and I.M.O. Course (1987).

It was the commander of School-Ship “Mircea” on time it was transformed on base-ship, part of 22 Dredging Brigade (1960-1962), lecturer at the Navy Department of Navy Institute “Mircea cel Bătrân” (May-June 1987) and lecturer at the Navy Practice Department of Navy Academy “Mircea cel Bătrân” (10 December 1989-1st March 1990).

Captain Alexandru C. Hârjan was born on 20 March 1926, at Bordenișeni, district Ialomița.

He graduated primary school in his village, Industrial Gymnasium Săpoca, district Buzău (1945), Superior Technical School of I.A.R. Plant Brașov (1947), Navy Officers Military School (1949), High School-Secondary School no. 2 Constanța (1960), Navy Institute “Mircea cel Bătrân” (1978) and Intensive German Language Course (1972).

He worked as an officer with Navigation and Signal on School-Ships “Liberty” and “Mircea” (May 1949-September 1950), commander subunits students, including battalion commander at Navy School (September

1950-January 1954), battalion students commander at Superior Navy Military School (August 1963-December 1964), commander of School-Ship “Mircea” (December 1964-September 1973), 306 Squadron School-Ships (September 1973-August 1978), professor at Navigation Department at Navy Institute “Mircea cel Bătrân” (August-21 November 1978), officer 2, officer 1 in Battle Preparation and Education Planning Office at Navy Institute (21st November 1978-30 November 1979) and chief of Navy Preparation and Ship Maneuver Department at Navy Institute (30 November 1979-1982).

He wrote the articles «School-Ship “Mircea” and Romanian Navy» (in “Marea noastră”, Year IV, no. 12/July-September 1994), “Path through Biscaia, November 1965” (in “Marina Română”, no. 25(3)/1994), «A regatta with major implication for the destiny of School-Ship “Mircea”» (in “Marea Noastră”, no. 11/April-June 1994), “An imperial visit” (in “Marea Noastră”, Year VI, no. 20/1996) and others.

Fleet Rear Admiral Zamfir I. Petre was born on 3rd October 1923, at Chioara, district Ialomița.

He graduated primary school from Medeea Neighborhood, Constanța (1934), high School “Mircea cel Bătrân” (1939), Navy Specialties School (1942), Physical education and Sport Military Institute (1948), Navy Officers Course at Navy School (1948). He worked as chief of Mobilization Office at Navy School (February 1948-April 1950), officer 2 on bombardier “Ghiculescu” (April-November 1950), chief of Mobilization Office and chief of Navy Preparation Department at Navy school (November 1950-January 1953), chief of Shipping Center (House Ship) Mamaia (June 1958-February 1959), navy instructor at C.O. Regional Constanța (February 1959-14 September 1960), chief of Navy Preparation Station at Superior Navy Military school (October 1960-September 1962), lecturer at Navy Preparation Department, Maneuver and Battle Preparation Method in Military Navy (September 1962-August 1963), superior lecturer for navy practice (August 1963-October 1964), deputy head at Navy Practice Department (October 1964-April 1966) and chief of Navy Practice department at Superior Officers Navy School, Navy Institute “Mircea cel Bătrân” (April 1966-1979).

He commanded the School-Ship “Mircea” during its march towards the site builder “Blohm und Voss” from Hamburg (12 October-10 December 1965), succeeding with a remarkable courage to save the ship and the crew from the terrible storm occurred in Biscaya bay on 25, 26 and 27 November 1965.

Captain Eugen I. Ispas was born on 23rd July 1934, at Tulcea.

He graduated the High School Tulcea (1952) and Navy School Constanța (2nd October 1957).

He was commander of students company, lecturer at Navy Preparation Department at Navy Institute “Mircea cel Bătrân” (1964-1966), officer 2 at School-Ship, “Mircea” (December 1966–5 October 1973) and commander of School-Ship “Mircea” (5 October 1973-1977).

Under its command, School-Ship “Mircea” had three complex instruction marches: between 29 June and 26 July 1974, in the Mediterranean Sea, with stops at Alexandria and Beirut; between 19 July and 24 September 1975, in the Mediterranean Sea and Atlantic Ocean, with stops in Gibraltar, Amsterdam, Le Havre, Londra and Palermo ports; between 4 March and 30 August 1976, the first crossing of Atlantic Ocean, in exclusivity with sails, for participation at “OP SAIL 76” and at the manifestations organized with the occasion of USA bicentennial, making stops in Las Palmas, La Guaira, Cartagena, Vera Cruz, Havana, Hamilton (Bermude Islands), Newport, New York, Baltimore, Philadelphia, Lisabona and Alger ports.

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He is honorary citizen of New York (USA) and Vera Cruz (Mexico).

Captain Dan-Ioan Gr. Stăiculescu was born on 15 August 1931, at Bolgrad, district Ismail, Basarabia, now Ukraine.

He graduated first class at Bolgrad, second and third at Pitești (1942), fourth at Bucharest, Military High School “D.A. Sturdza” and High School „Gheorghe Lazăr” Bucharest (1950), Navy Officers Military School (1957).

He worked as a lecturer at Navigation Department from S.M.S.M. (September 1963–30 December 1967), navigation officer (30 December 1967–5 October 1973), officer 2 (5 October 1973–15 August 1978) and as School-Ship “Mircea” commander (1st January 1978–March 1990).

Between 15 July and 30 August 1967 he participated as a lecturer and as a Navigation Fighting Unit commander at the instruction march made by School-Ship “Mircea” in the Mediterranean Sea and Atlantic Ocean, with stops at Toulon and Portsmouth. As a commander of School-Ship “Mircea” he conducted the following instruction marches: between 18 June and 28 July 1979 in the Mediterranean Sea and Atlantic Ocean, with stops at Istanbul, Livorno, Lisabona and Pireu; between 30 June and 9 August 1980 in the Mediterranean Sea with stops at Toulon, Barcelona and La Valletta; between 21 July and 14 August 1986 in the Black Sea, with stops at Istanbul, Odessa, Sevastopol and Varna; between 4-29 July 1987 in the Black Sea, with stops at Burgas, Suhumi and Sevastopol; between 28 July and 20 August 1988 in the Black Sea, with stops at Varna, Istanbul, Novorossiisk and Odessa; between 18 July and 1st August 1989 in the Black Sea, with stops at Varna, Istanbul and Sevastopol.

Captain Dinu-Sorin M. Pampărău-Sălăvăstru was born on 19 July 1951, at Dumbrăveni, district Suceava.

He graduated High School no. 3 Suceava (1972), Navy Institute “Mircea cel Bătrân” (1977), Weapons under Water Specialist Course, Ship Commanders Course, Command and General Staff College (1998).

He worked as officer 2 (1981-28 April 1990) and School-Ship “Mircea” (28 April 1990-2006), with which he made the following instruction marches: between 10 July and 10 August 1990, in the Black Sea, with stops at Novorossiisk, Sevastopol, Istanbul and Varna; between 15 and 22 July 1993, at Istanbul; between 31 July and 6 August, at Istanbul; between 19 April and 25 September 2004, the second crossing of Atlantic and the participation at „Tall Ships Challenge 2004” regatta, Marmaris (Turkey, April-May 2005) and in the North Sea (June–September 2005).

Captain Gabriel Moise was born on 8 January 1970, at Pitești.

He graduated Military High School “Alexandru Ioan Cuza” (1988), Military Navy University, navigation specialty at Navy Academy “Mircea cel Bătrân” (1993), Combat Divers Course (1996), master courses at Civil Navy University from A.N.M.B. (September 2006) and English Language Course (March 2007).

He was platoon commander at Navy Forces Army apprentice Military School (1995), officer 2 on School-Ship “Mircea” (June 2001-1st October 2006) and School-Ship “Mircea” commander (1st October 2006 till present).

At the board of School-Ship “Mircea” he participated at instruction marches and regattas organized by Sailing Training International in the Atlantic Ocean (USA and Canada East coast) - Tall Ships Challenge 2004, North Sea (Great Britain, Norway, Holland, Belgium, France) - Tall Ships Race 2005, Mediterranean Sea (Spain, Tunisia, Italy, Malta), Aegean Sea, Marmara Sea (Turkey) and Black Sea (Bulgaria, Ukraine, Russian Federation).

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THE IMPORTANCE OF TRAINING FOR ROMANIAN SEAFARERS COMPETITIVENESS

Ion NĂFTĂNĂILĂ¹
Cristina NISTOR²

¹ Prof. univ. dr., Academy of Economic Studies, Bucharest

² As. univ. drd., Constanta Maritime University, Constanta

Abstract: *In maritime transport, competitiveness of seafarers can be acquired by appropriate training. Unfortunately, some shipping companies prefer to spend financial resources on higher salaries than their competitors in order to attract and maintain personnel, rather than investing in training and in courses for professional and personal development of seafarers. This paper presents the importance and the effects of training of seafarers on safety and competitiveness.*

Key words: *maritime transport, seafarers, training, crew, competitiveness.*

1. Introduction

The maritime business is of strategic importance to all Europeans, since in economic terms, 90 % of the EU's external trade and 40 % of internal trade is transported by sea. Europe benefited in 2007 from a world boom in the global shipping market. To maintain success in the current crisis period, investment must continue against the background of increasingly global competition and dynamic changes of the business environment.

Business Excellence in Maritime Transport is dependent on the way in which seafarers or shore based personnel and technology work together during operations.

When considering the overall picture of maritime business, personnel recruiting and training are high on the list of matters that influence competitiveness, safety and excellence in operating cargo and vessel.

There have been made increasing efforts to gain an awareness of human element issues. The traditional view that human error is the major cause of all accidents is being challenged by some who consider human error to be a symptom of deeper problems with the system. Errors can be induced through bad design, poor training or poor/inadequate management systems. Indeed, some argue that modern technology has reached a point where improved safety can only be achieved on the basis of a better understanding of human element within the system.

Human component must evolve from initial capability analysis, through all the lines of development. Dr. John Huddleston and Daniel P. Jenkins from Cranfield

2. Importance of Training for Seafarers Competitiveness

Traditionally, the purpose of training and development has been to ensure that seafarers can accomplish their jobs efficiently. Today, during the financial world crisis, the business environment has changed, with intense pressure on organizations to stay ahead of the competition through innovation and reinvention. Strategic positioning of training and development directly promotes organizational business goals and objectives.

Current trends emphasize the importance of training and intellectual capital, a critical factor for competitive advantage. The development of partnerships for knowledge sharing (e.g., consultants and/or academic partners as subject matter experts) has increased. To develop specialized training programs in corporate university settings, training departments often work closely with academic partners to prepare high-potential seafarers for leadership roles. When strategically applied, continuous learning fosters knowledge and skills acquisition to help the maritime company achieve its goals. Human resources department role is to establish and implement a high-level roadmap for strategic training and development. The starting point is an in-depth understanding of the business environment, knowledge of the organization's goals and insight regarding training and development options.

University speaks about into Capability Management Plan and subsequent systems development used in analysis of training needs in order to ensure that Human Factors Integration processes can make the optimal contribution to operational effectiveness. If the human component is not managed at the strategic level, it will difficult for Human Factors Integration to operate effectively within programs.

A well-trained crew and a well-manned vessel impacts on every facet of the ship's operation and is an issue that must not be ignored. Ship operations in maritime business is a commercial enterprise similar in many regards to any other profit-making organization. It has shareholders interested to make a return on their capital and stakeholders. (Malpass, 2005) The board of directors have the duty to deliver that return while at the same time ensure that this is achieved in a professional, responsible, safe, qualitative and timely manner.

A competitive maritime company is the one that clearly states a mission reflecting a serious commitment to international transport activities and has the ability to identify and adjust rapidly to client's needs and opportunities providing high-quality, competitive navigation services. The following elements are determinants for a firm's international competitiveness: specific assets and core competences that can be exploited to their competitive advantage, reputation, continuous innovation in ship building, ship design or ship services, shown in particular in passenger cruises, a firm's architecture which describes the culture of the company.

HR must then develop strategic learning imperatives (high-level, learning-related actions that an organization takes to be competitive) that align with business goals. Differences in industry, business goals, human capital skills and resources influence the selection of learning imperatives. (Tannenbaum, 2006).

In maritime business, competitive firms are the ones that provide qualitative transport services at a competitive price. (Nistor, Surugiu, 2009). Business excellence and competitiveness can be achieved at the early stage of selecting personnel. For selection of crew members, maritime companies make a psychometric profiling, interviews, aptitude tests and portfolio determination. Entry level solutions are pre-sea courses for cadets, counseling, distance learning, STCW courses and system training. Professional competence is acquired after passing competency courses, simulation training. For professional competence, an important tools are assessment and on board mentoring. Enhancement is provided by using advanced simulation training, leadership and teambuilding programs, customized training based on the needs of the team. A constant analysis of productivity is also recommended for up to date results. The training system that a competitive company must take in consideration is not only limited to shipboard training. Shore based training implies

external courses like STCW 95 mandatory course, competence and soft skills enhancement courses. In house shore based courses are related to company's system and policies, safety, productivity and loss control. The objectives of structured shipboard training are acquiring theoretical knowledge, familiarization and drills, mentoring and next rank training.

Many maritime companies are registered in tax-free fiscal paradise countries because of advantageous tonnage tax regimes. In many cases, this does not encourage companies to train crew and master to a higher level, but rather attracts those who wish for commercial advantage with the minimum amount of training required by the international regulations like IMO Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW). Such companies should take into consideration that business excellence is acquired by those that take into consideration the level of non-mandatory training, apart from those regulated by International Maritime Organization in order to establish the quality level of the crew and to ensure a supply of high caliber officers needed for the high-tech vessels of tomorrow. This issue has a major impact on a vessel's earning potential.

In order to be legally acceptable, maritime companies must comply with operational rules issued by International Maritime Organization (IMO), employment condition issued by International Labor Organization, National Flag legislation and local country legislation and condition imposed by International Transport Workers Federation (ITF) imposed or agreed with the relevant unions.

IMO's Standards of Training, Certification and Watchkeeping (STCW) Convention was drafted in 1978. In its first version, it had the scope to formalize a system nearly identical to the US marine system, around the world. In 1995 when the US Coast Guard approached the International Maritime Organization and asked them to amend the convention, significant changes were made. The STCW 95 amendments did not have to be ratified like the original convention because it was an amendment to an existing convention. The amendments, however, completely re-wrote enforcement related to the Convention, and more importantly created an STCW Code that set stringent standards for mariners to meet. Unlike the original 1978 Convention, the 1995 Amendments required a separate piece of paper to certify that the mariner met the requirements - a STCW Certificate. The traditional way of studying human performance in the maritime work domain is through the

3. Ways to improve the crew personnel strategy

Improving the personnel strategy includes a general evaluation of the company focusing on a good business plan, analysis of the human resources by establishing the portfolio of human resources and the efficient manning pool and the analyze of the existing situation, of the distributed tasks and of the motivational system.

A favorable external medium for the maritime company is set by creating interesting jobs and developing strategies for attracting valuable personnel. The decision factors must notice the aspects which influence the personnel fluctuation and must find solutions for solving them. The causes which increase the emigration of personnel might be lack of material motivation for the specialists or politics for keeping the personnel with low qualification. The company should implement periodical brainstorming meetings at shore and at the board of the ship for collecting good ideas and motivating the personnel. Ways of increasing the number of employees with superior qualification are reducing the ratings and personnel with medium studies and increasing the number of personnel with proper qualifications.

In Romania, competitive maritime companies are the ones that hire seafarers after they passed a technical computer exam in English and a very well structured interview. Competitiveness is acquired when seafarers act as

4. Conclusions

To maintain success in today crisis period, investment and innovation in recruitment and training

analysis of accident reports or even better through the analysis of accidents. 80% of maritime accidents are caused by human factors or human error. Experts who make accident reports evaluate in the first stage the human performance in the particular case against the performance standard you could expect from the crew in the given situation (Barsan et. al, 2007). According to international regulations, after any incident needing the involvement of authorities, the first thing an inspector of Marine Investigation Branch does on boarding the vessel is to check the competence and training of the seafarers on board.

Good quality training is a prerequisite to ensuring a vessel maintains a high standard of operation. Training in all its forms adds to the value and safety culture on a vessel. From the legally imposed training certificates of competence to the cadet programs of practice at the board of the ship, it is essential to understand the strategic importance of operating a vessel to the highest levels.

For crew members aspiring to higher ranks, statutory training is carried out as they seek for promotion, but a good ship operator will have their own in-house training program that will help reinforce the company's culture and safety. Undertaking responsibility ashore means learning many new skills. Skilled officers make excellent managers but the knowledge prescribed to prove competence at sea leaves gaps in a number of disciplines required in an effective competitive ship management company.

A great number of companies today have human resource sections instead of „personnel department” that were used in the past. This is the part of the company that is responsible to the CEO, the board of director and shareholders for ensuring that the operational matters of crew deployment are carried out successfully.

A well-trained seafarer is the most valuable asset an owner has on board. Companies must meet the requirements for which they are directly responsible. Having well-trained seafarers is essential to any maritime company who wishes to demonstrate that responsibility, while at the same time be seen by the community as having quality and competitive operation.

Competitiveness means professionalism and high productivity. At the level of maritime company, it means cost efficiency and cost effectiveness. But competitive companies don't cut costs with training systems for seafarers and invest in sending employees to international conferences and seminars on safety issues and safety management.

professionals in every action they make at the board of the ship or on land. Employment conditions for seafarers should be at least comparable with those found in other industries – particularly in view of the obvious impact that the quality of the shipping industry's workforce has on safety at sea and protection of the marine environment. Applying a professional way of thinking, not only in their job, but in life in general, brings satisfaction.

Maritime companies can assure the adequate resources for the continuous professional training by internal and external financing of professional training.

Finally but not exhaustively, the company should believe in investing in its people for its success, supporting employee development to grow talent from within by using a Performance Management Plan. This is a strategic performance tool which support strategic plan and goal attainment of the organisation. The objectives of a Performance Management Plan is to compensate related decisions, promote the crew's potential, establish efficient rewards and recognition systems, helping objective or equitable decision making. By using a Performance Management Plan, the management can identify proper training needs. This tools is also used to document and analyze performance and to promote a high-performance culture.

programs must continue in order to achieve a competitive status. Used on a large scale, seafarers recruitment training programmes can give a competitive edge. Their aim is to

select and equip new entrants to the maritime industry with the skills and knowledge to pursue a career at sea and to perform their jobs better. The training programmes are also essential to gain new set of skills and knowledge for seafarers career transition. In order to acquire competitiveness and business excellence in this business, the management of the maritime company should state a clear vision so that the crew

members can understand the expectations of management. A solution for establishing derived strategies, in specific areas of the personnel activities, in consonance with the concrete conditions of the international environment is to develop partnerships for elaboration and implementation the strategies in continuous professional training.

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IMPROVING ORGANIZATIONAL PERFORMANCE

Filip NISTOR¹
Cătălin POPA²

¹ Assistant Lecturer eng. Filip Nistor, Naval Academy „Mircea cel Batran“ Constanta

² Lecturer Cătălin C. Popa, Naval Academy „Mircea cel Batran“ Constanta

Abstract: *One of the most important shifts in the emphasis of HR management in the past few years has been the appointment of HR as a strategic business contributor. Even organizations that are not-for-profit, such as governmental or social service entities, must control their human resources as being valuable and in a “businessoriented” manner.*

Keywords: *HR management, performance, organization, merger, acquisitions*

Introduction

Organizational performance can be seen in how effectively the products or services of the organization are given to the customers. The human resources in organizations are the ones who design, produce, and deliver those services.

Therefore, plan of action of HR management is to establish activities that contribute to superior organizational performance [1]. Only by doing so can HR professionals justify the claim that they contribute to the strategic success of the organization.

Participation of HR in Strategic Planning

Strategic planning can be characterized as the process of identifying organizational objectives and the actions needed to accomplish those objectives. It involves analyzing such areas as finance, marketing, and human resources to determine the capacities of the organization to meet its objectives.

Integral to being a strategic partner is for HR to have “a place at the table” when organizational strategic planning is being done. Strategically, then, human resources must be viewed in the same context as the financial, technological, and other resources that are managed in organizations. Because top managers are responsible for overall strategic planning, they usually ask the HR unit to project the human resources needed to carry out overall organizational goals.

For example, the strategic planning team at one consumer retailer was considering setting strategic goals to expand the number of stores by 15% and move geographically into new areas. The HR executive supplied information on workforce availability and typical pay rates for each of the areas and recommended that the plans be scaled back due to tight labor markets for hiring employees at pay rates consistent with the financial plans being considered. This illustration of HR professionals involving in strategic planning is being seen more frequently in organizations today than in the past.

Deciding on Mergers, Acquisitions and Downsizing

In this era of mergers, acquisitions, and downsizing, many workers have been laid off or had their jobs eliminated due to closing of selected offices, plants, and operations. In many industries today, organizations are merging with or acquiring other firms. One prime illustration is the banking and financial services industry, in which combinations of banks have resulted in changes at Bank of America, Nations Bank, First Union, and others large and small.

The merger of Ford and Volvo has had significant implications for the automobile industry. Many other examples could be cited as well.

In all of these mergers and acquisitions there are numerous HR matters associated with combined organizational cultures and operations. If they are viewed as strategic contributors, HR professionals will take part in the discussions prior to top management making final decisions. People of Human Resources department spend a lot of time in any firm that is proposed for merger or acquisition to determine if the “corporate cultures” of the two entities are compatible. Two potential acquisitions that were possible financially were not made because he determined that the organizations would not merge well and that some talented employees in both organizations probably would quit.

Redesigning Organizations and Work Processes

It is well proved in the strategic planning process that organization structure follows strategic planning.

The meaning of this concept is that changes in the organization structure and how work is divided into jobs should become the vehicles for the organization to drive toward its strategic plans and goals.

A complete understanding of strategic sources of competitive plus for human resources must regard analyses of the internal strengths and weaknesses of the human resources in an organization. Those in HR management must be the ones working with operating executives and managers to revise the organization and its components. Ulrich suggests that HR managers should function much as architects do when redesigning existing buildings [2]. In this role HR professionals prepare new ways to align the organization and its work with the strategic thrust of each business unit.

Assuring Financial Accountability for HR Results

Numerous studies have shown that a firm’s market value (the sum of the value of the shares) is not fully explained by its current financial results [3] or its tangible assets and the focus has moved to a firm’s intangible assets such as intellectual capital and customer relationships – all of which are derived from human capital. A final part of the HR management link to organizational performance is to prove on a continuing basis that HR activities and efforts lead to the financial results of the organization.

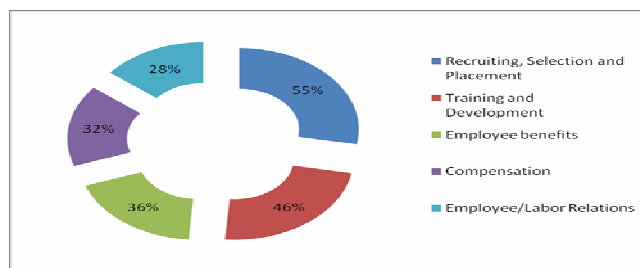
Traditionally, HR was seen as activity-oriented, concentrating on what was done, rather than what financial costs and benefits produced from HR efforts. For instance, in one firm the HR director reported every month to senior

management how many people were hired and how many had left the organization. However, the senior managers were becoming increasingly concerned about how long employment openings were vacant and the high turnover rate in customer service jobs. A new HR director was hired who conducted a study that documented the cost of losing customer service representatives. The HR director then requested funds to raise wages for customer service representatives and also implemented an incentive program for those employees. Also, a new customer service training program was developed. After one year the HR director was able to document net benefits of 100,000 € in reduction of turnover and lower hiring costs for customer service representatives.

In the past, HR professionals justified their existence by counting activities and tasks performed. To be strategic contributors, HR professionals must measure what their activities produce as organizational results, specifically as a return on the investments in human resources [4]. HR management that focuses on high performance work practices has been linked to better financial performance of the organization [5].

This change over to being a strategic business contributor requires that all HR activities be examined and justified as producing results and value for the organization.

Figure below indicates the HR priorities according to a recent survey of HR executives.



Source: Bulletin to Management, vol. 49

For instance, training must be confirmed by the increase in capabilities of employees and the value that training produces in greater organizational results.

In summary, HR must justify its existence as an organizational contributor, and not just a cost center.

Conclusion

To improve organizational performance, human resources management must be involved in strategic plans

and decision making, participate in redesigning organizations and work processes, and demonstrate financial accountability for results. Variable-pay programs, including those that are team based, are being used to enhance organizational performance and reward greater employee participation in work teams.

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TRAINING PERSONNEL FOR TODAY'S PORT

Filip NISTOR¹

Haralambie BEIZADEA²

¹ Assistant Lecturer eng. Filip Nistor, Naval Academy „Mircea cel Batran” Constanta

² PhD Prof. eng. Beizadea Haralambie, Naval Academy „Mircea cel Batran” Constanta

Abstract: *Increasing trade and a reducing labour pool could eventually take its strain on ports. The goal of human resources department from a port company is to find port personnel who either possess or have the potential skills and attitudes that will enable a port business to carry out the tasks necessary for the achievement of its aims and objectives.*

Keywords: *port, training, standards, personnel*

World seaborne transport has greatly intensified over the past few years, substantially increasing port throughput. This traffic increase cannot be compensated for simply by employing technology. Implicit technological changes, increase of port facilities and continuous integration of ports as seawater interfaces in the logistics chain, also have an important impact on labour requirements. Training is a learning process in which learning opportunities and experiences are designed and implemented, which aim in developing the knowledge, skills and attitudes related to the present job of the learner.

Changes take place in infrastructure, technology, competition, intercorrelation with other mode of transport will lead to the creation of jobs and discipline, which are new to the traditional port industry. Innovative and relevant education and training of port personnel at all levels is required. Cooperative training programmes will have to be prepared to

provide minimum standards and certification in basic training for ports and terminals in safe work practices, security, environmental protection and protocols that are common to all cargo types.

The management of port companies will have to obtain hire and retain suitable port personnel that would contribute to the efficiency (best possible utilization of resources) of the port. The evolution in cargo handling has enormous human resource implications. While containerization contribute to a reduction in the number of labourers who loads and unloads vessels in a port (dockers) needed to handle each tonne of cargo, the vast increase in cargo, rise in productivity and massive scale of today's hub ports means there is still a need for thousands of well-trained employees on the harbour.

Some ports offer trainees the chance to experience a wide range of roles including logistics, IT, crane operations and engineering. CMA-CGM, for example, has its own university at its Marseilles headquarters. Maersk requires all its trainees to take its MISE (Maersk Integrated Shipping Education) course in Copenhagen. These days, entrants for such courses are likely to be graduates who can speak at least two languages (one of which is usually English). Any training offered should incorporate horizontal career move opportunities and life-long learning. Modules covering a range of sectors within the port - terminal operations, cargo and commodities, ship planning, ship types, for example - may be necessary, along with on-the-job training. Many may need to improve their competence in the English language. The best approach, therefore, involves a coming together of learning and working to give the employee the right skills, and this so-called 'learning by doing' will help the trainee get a better grasp of problems. It is increasingly difficult to recruit professionals with the right experience and training for pilot and VTS officer positions. In particular, port operators and service companies had to find potential employees with a master's certificate. For both pilots and VTS operators seagoing experience is generally considered vital. An effective VTS operator should have a captain's view, to undertake the job. This level of awareness is even more pertinent today as the size of vessels increases. In an effort to find what is the best on labor market, the port companies has attempted to improve conditions of employment, with incentives including free housing, free travel for journeys home and family visits to the employee's working location.

There are also efforts to make jobs more interesting by allowing employees to attend industry conferences and providing local education. Success in recruiting and retaining staff increasingly depends on making employment more family-focused. The added costs of attracting the best candidates and retaining key staff are a price worth paying-particularly when set against the substantial consequences of shipping accidents.

Port managers now need skills that embrace both general and service operations management. Not only this, but in today's highly competitive environment, it is crucial for

Conclusion

Training is necessary to achieve improvements in work performance, particularly when ports invest in new equipment, introduce new work procedures or redesign the workplace. Training helps align the objectives of a company with the requirements of employees i.e. skills attainment, satisfaction in their work, career advancement and life-long learning. Training takes place at a specific time and place is

port managers to deal with customers' expectations and related service quality factors. Customers in this context are not just shipping lines but also global shippers and logistics firms. Some companies have implemented special personnel development programmes based on a cross-functional and cross-cultural perspective with a special focus on leadership.

Some port executives undertake a part-time degree-level course in maritime transport and logistics at maritime universities. The maritime industry's approach to education has changed. In the past, employees started at sea and then continued their careers in ports. Today, a high level of technical and strategic knowledge is expected, so employees have a growing need for learning concepts that take into account the natural working life-cycle in the maritime industry.

It is time to focus on integrated programmes and education with a continuous professional development approach that facilitates high mobility between sea and port labour. Any education offered should seek create a mobile labour force supported by international recognition and accreditation. Training needs the support of the state, of management and of learning institutions.

States support training to quite a considerable extent because it contributes to the success of the companies that avail of training programmes and it augments the life-long work ambitions of the trainees.

Training needs the support of management to specify their training requirements, to cover their share of the cost and to release people to participate in training programmes. Training also requires the support of the training institutes and. CERONAV (Romanian Maritime Training Centre), Naval Academy „Mircea cel Batran” and Maritime University, are two universities and a institute that provide professional training that is relevant to managers working in port companies. Universities that have an association with large hub ports provide a range of training programmes that are relevant to ports' personnel. Cooperative training between two or more universities and institutes in the spirit of the Bologna Accord could be organized to provide specialised modules to different partners from region.

usually vocationally relevant and limited to specific aims and objectives. The understanding and right application of the appropriate training theory put up the foundation for effective training in the port industry. The lack of training is also a contributing factor to high accident rates and crippling insurance claims. *“Getting the right people and getting the people right”*

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THE IMPORTANCE OF DETERMINING BODY COMPOSITION IN ATHLETES AND UNSPORTSMANLIKE

Olaru CRISTINEL¹

Osman FESCI²

¹ Asistent, Naval Academy, Constantza, Romania

² Comander, Forces Army Academy, Ankara, Turkey

Abstract: The determination of body composition is a basic measure of health status and capacity of the athlete's effort and for the general population. Body composition is one factor that contributes to athletic performance. The percentage of fat varies according to age, sex, and the sport and by sport practiced, training status, energy intake. The unsportsmanlike, determining body composition is important for proper assessment of nutritional status and treatment monitoring nutritional imbalances.

Keywords: body composition, active mass, fat.

1. INTRODUCTION

Body composition is one of the factors contributing to athletic performance, its determination is an important component of monitoring dynamic performance athletes, keen to improve maximum performance. The model with two components, the human body is composed of mass non-fat and fat mass. Fat mass is composed of essential fats (from bone marrow, heart, lungs, liver, spleen, kidney, central nervous system) and fat deposit (acquired in fat located around organs and subcutaneous). The ratio of subcutaneous fat and internal fat is not the same for all individuals and can vary throughout life. Lean muscle mass is the weight, bones, ligaments, tendons, internal organs, teeth. Mass weak differ in mass NON-FAT.

Weak table includes a small percentage of fat essential (the bone-marrow and internal organs). From this mass weak (active table), a component which recorded the biggest muscle tissue is VARIATIONS (musculature). Mass substance that is carried out the effort, and weaving in excess tissue has adversely affect the health and sports performance.

2. DEXA methods

Body composition can be assessed by several methods. Weighing under water and DEXA (dual- X energy ray absorptiometry) are the only test methods which have been validated by scientific and are therefore deemed "gold standard" in determining the composition tangible; they are still expensive and inaccessible.

In practice gymnast, determining the composition tangible is done using the test of tissue subcutaneous tissue. The method is practice, cheap and the exact same time and non invasive. The results are close to those obtained by the method weighing under water and DEXA, but it needs the experience to obtain accurate results.

Measurements are made using a specific instrument at the level of specific areas of the body. The results, expressed in mm, introduce the formula and obtain the percentage of tissue and Table substance.

The percentage of tissue recorded wide variations on the basis of sex, age, AGVPS and unsportsmanlike.

A certain percentage of tissue is absolutely necessary for maintaining health. lipids essential are essential for proper functioning of the body, and women have a percentage greater than lipids essential than men. The optimum level for the health fat unsportsmanlike is tangible in adults 12-18% (10-25%) for men and 16-25% (18-30%) for women.

Athletes have lower values of tissue to unsportsmanlike. The percentage of tissue for athletes with performance varies depending on the broad limits of VEDETE and 6-13% (19 percent higher classes of throwers and weight) to men and 12-19 percent to women. Weight changes and the tangible composition at the AGVPS relate to the state of training, training period and energy intake. Some studies have shown that the percentage of tissue is vice versa in proportion to the maximum capacity and aerobic performance in running over long distances, and the mass is active relate to the performance in sports IN WHICH IS NECESSARY force maximum.

In many sports is a low level of tissue. Excess tissue makes fall ability to jump, speed by running and ability very. There are AGVPS overweight (-, was) with a muscular

body construction, but with low percentage of tissue with tissue and musculature very well developed. CAS with a good table active can withstand a percentage of tissue increased subcutaneous tissue (rugby, over the athletics), but this increase should not be coupled with increased blood lipid and on the.

Them long-distance (especially women) have a percentage of tissue more than runners or road background.

In sports like gymnastics, running's, - Fund, the pole vault event in athletics is a necessary allure with good and active tissue mass minimum tissue.

The body weight and body composition are essential in gymnastics artistic since exercises carried out against gravity. Too, determining the composition tangible and the percentage of tissue is important to sports with weight category (judo, fight, boxing, and weightlifting) for the election fair category of weight.

Sports artistic impression in the matter (gymnastics, the pole vault event in water, you artistically) are essentially sports with weight category, in which small body weight and body composition optimum are essential.

Monitoring weight and composition in tangible dynamic give us information useful for directing the process of training and food intake to AGVPS.

Determining the composition and tangible is useful for children and adults unsportsmanlike to appreciation correct the condition of nutrition and development of appropriate therapeutic indications.

The body weight and not give BMI, however, information about the amount of body fat. People who do a physical activity supported have musculature very good and BMI increased without have tissue in excess. Although there are individuals who are situated at normal weight for age - what his own stature (or even under the weight) have excess tissue.

There are also people overweight (especially women) who values very small of tissue, with negative consequences of the health status. Studies have shown that starting with the percentage of adult age muscle tissue falls and tissue grows the tissue. Even individuals who have weight Normative and he maintained, they lose muscle tissue and put tissue, because sedentary style of life with few exercises and many fat diet. But using exercises and an adequate diet is possible construction of musculature to adults and even the elderly.

Quantity tissue in the body is also given the number and size cells fat tissues. Tissue growth tissue can be on the increasing number of adiposities (increase hyperplasia), either on the increasing numbers of cells fat tissues, the accumulation of protein intracellular (increase obstructive). The increase hyperplasia's characteristic childhood, period protuberates and puberties, and cells fat tissues once formed persist throughout life. Increasing the number of adiposities in childhood has negative consequences in the long term.

Obesity is a chronic disease of the more frequent among children and adolescents, caused most often wrong and food for the skills insufficient Physical activities and the child with members of a percentage increased tissue is apt to obesity in adult life. The amount of tissue, and not the total weight of the body, is that define obesity. Currently, obesity is recognized as a factor of risk, independent, for diseases were and diabetes.

That is why it is very important maintaining a tangible optimal weights and compositions in childhood. Determining the composition tangible is important to monitor the effects physical and/or diet on assets and tissue mass tissue. People who drop in weight through a restrictive diet

lose as much, or even more, the mass substance than fat. Sometimes, though associate diet and physical exercise, body weight does not change in the first weeks - months, but there will be tangible changes in composition downward tissue growth and tissue mass assets.

3. CONCLUSIONS

Beneficiary brought the physical exercise associated diet for the drop in weight is just keeping assets and subtracting tissue mass tissue, which is equivalent or even higher than the drop in weight.

The drop in correct weight must be made by associating with physical exercise a proper diet (in no case by starvation) and under the control of regular tangible composition (the percentage of tissue).

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A NEW-FANGLED METHOD TO PSYCHOLOGICALLY INFLUENCE THE HIGH PERFORMANCE SPORTSMEN AND STUDENTS

Naie Gilles OPRİŞAN¹

¹ Lecturer Ph.D, Naval Academy „Mircea cel Batran” Constanta

Abstract: *This presentation has as objectives to emphasize new ways to practically use the theory of human biological rhythms in order to positively influence the global human performances and particular the momentary performances of the sportsmen. This work represents the synthesis of long time researches of the author, in the space of influencing the performances of the sportsmen (as well as the navigators) to reach the highest level in the competitions or to ensure the highest professional qualities of the work aboard the ships. The novelty of these applied researches is focused on the use of computerized techniques of the bio-rhythmical behavior of the human body functions to reach the goal we suggested above. The psycho-pedagogical manners we used to fulfill our task brought in some very important conclusions concerning the major influence of the psychological feature in some activities involving both the psycho-physical and intellectual contribution.*

Key words: *Bio-rhythm, psycho-physical output, work capacity, psychological influence, sports performance, professional capacity, etc*

I. INTRODUCTION AND THE RESEARCH OBJECTIVE

The biological rhythms, as a general expression the living matter, were the subject of study for many researchers, and scientists. Some of them are happy, part of them not at all, about the controversial substance of the domain. The main cause of the situation consists in the fact there's no strict and visible accord between the mathematical accounts and calculations of the theory and the observations of natural evolution, strictly objectives. This confrontation leads to doubt about the theory principles or even worse, to reject the bio-rhythm theory.

We consider, that until now both the supporters of the theory and the rejecters, each one with own reasons, are equally right at a first sight. Reading this assertion, the reader is going to be upset because he can't understand where the truth is! He's expecting a clear, obvious point of view, black or white.

We'll present in this work a few aspects of our point of view, in tight link with the study, the interpretation and mostly with the practical evaluation of the human bio-rhythms theory, and we'll put a stress on a particular position, serving the interest of both opinions we presented above. We certainly hope these opinions to raise interest and clarify the

II. SHORT HISTORICAL NOTES ABOUT THE EMPIRIC AND SCIENTIFIC RESEARCHES IN THIS RESPECT

They made lots of observations along the history, initially empirically. Influenced from the very beginning by Pithagora's doctrine, the famous physicians of the antiquity, Hypocrates and Galenus considered they are bad luck days in our lives when the man is more sensitive, therefore he can

controversial opinions over this problem. Considering the practical gains in the field, the subject deserves this study in our opinion. The several hypotheses to follow, as well as the presentation of some practical evaluation methods of the human bio-rhythms in psycho-pedagogical field are going to be but a humble contribution, a personal point of view in the research. We are positively sure these opinions will be useful for the following researches in the field. I also have to thank the ones that are going to adopt my point of view and support it as well as to the ones to deny it. This way we may be sure in the science there will be light at the end of any research field. The theme of the human bio-rhythms has been studied by very many physicians, teachers, psychologists and astrologists. All of them concluded the human life is influenced by the natural conditions and the evolution. The human capacity is waving; it's not the same all the time is certainly depending of the environmental factors, his own nature and even the astral influence.

The main objective of the scientific researches was to find out new practical ways to psychologically influence in a positive way the human performances evolution, and especially the sportive ones.

get ill easier than usual. The aggravation or the improvement in some special days or at a special hour was considered to be a prognose element. So, even they noticed the waving characteristic of the human behavior, comparing the capacity to face some sickness.

Some other authors studied for example the level of the psycho-motion and intellectual capacity of the people

involved in some different activities (especially at work) and concluded a clear variation of these capacities along the daytime. After studying different scientists experiments and added his own, the physician Sollberger (1969) concluded, the sensitivity and the reaction of the human being to different pills and medicines is also different at different hours of the day, being more or less efficient !

John Beard (1879) and Herman Swoboda (1902) described independently the rythm of the physical capacity, that is cycling at the physical level every 23 days and at the psychical level every 28 days.

In 1905 Wilhelm Fliess describes without knowing about the other researches the same cycling of 23 and 28 days. The intellectual rythm of 33 days is discovered first time by Alfred Tascher and eventually by Roxford Hersei in 1928.

A soviet scientist, Gazenko (1970) studied the physiological and psychological elements in a cosmic 18 day flight in the „Soiuz 9” program. He concludes that the physical and psychical efficiency in the long time flights could be kept at the same level only in case the personal natural bio-rythms of the astronauts are not perturbed, even in the space ship conditions.

Anohin (1975) notice that the outer world actions on the human being, have some temporally series repeating a special rythm, kept at the same level on and on. That means the same rythm to repeat influences the human being, his evolution.

Stefan Popescu (1981) concludes that in order to adaptate, the living beings make clear they temporally coordinate their actions with some personal characteristics, and also in tight link with their biological efficiency.

The first one to start the bio-rythms in sport was A. Judt. His researches started with the variations of

performances levels , deciding that the sportsman date of birth is linked and the momentary performance level.

We have to notice also the studies of the Romanian scientist Stefan Milcu, concerning „*The bio-rythms...in the chrono-biology of the endocrine system*”. „*The observation materials, determined the scientists to lay foundation of a new science as **bio-rythmology**, or a similar term as **chrono-biology** studying the changes of the human being according to the time progress. If the chronobiology is a fundamental science having as main objective the knowledge, its importance is increasing by the perspectives to apply its conclusions in the practical activity, in the medicine*”...they noticed the chrono-biology gave birth to new disciplines as „**chrono-pathology**” I mean the study of the mechanisms leading to the conclusions we may get ill depending of the time, „**chrono-pharmacology**” that means to study the relationship between te medication and the body depending of time, „**chrono-therapy**” a practical method to apply tratments according to the variations of the biological constant features in time. Therefore it exists “the possibility to give a medicine at a certain hour previously established as being the most efficient, and giving the less side effects. As a medicine can have a different action at different hours, and chrono-biology is able to decide these periods of efficiency, along the 24 hours of the day”.

Emil Bilodeanu is the one who proposed a system to not and evaluate on mathematical basis in order to lead to practical results in sports activities. His idea was also supported by Univ. Lect. Vasile Marcu, prof. Ioan Ernest Ilea and some others. This scale of the body state from the bio-rythm point of view (monthly-physically psychologically and intellectually) looks like below (level).

Table 1

| The note | Physical rythm | Psychical rythm | Intellectual rythm |
|----------|----------------|-----------------|--------------------|
| 10 | + | + | + |
| 9 | + | + | - |
| 8 | + | - | - |
| 7 | - | - | - |
| 6 | + | + | 0 |
| 5 | + | - | 0 |
| 4 | - | - | 0 |
| 3 | + | 0 | 0 |
| 2 | - | 0 | 0 |
| 1 | 0 | 0 | 0 |

Not 1 could be the day the three curves of the monthly bio-rythm are touching in the same time the critical point

The living being is a part, a compound of universal huge system and in the same time a main way the universe expresses itself! To be more clear, we can take into account the environment, terrestrial and extra-terrestrial, where a lot of factors act from outside. These factors (a lot as I said) are named **natural action**, some of them well known, some other ones not yet known act themselves in a different manner. Some of them are unpredictable, accidental, and anyway irregular (but all that into the limits of our knowledge). Some other are having cycling action, approximate regular, but also known only from the mathematics' conclusions.

All these external factors with a cyclical motion and action, prolonged their action over the human being and all the other beings on Earth building up what we call natural frame for the development and evolution of entire life on earth. On the other side, in spite all beings evolved in the same natural space, (the differences depending only by the

position on the planet) we can say that almost any one of the individuals has his own way he developed, he became, he evolved, his own reactions to the natural factors, being different from another one living next to him.

Opposing the external natural space the external factors influencing with different results, the great variability, **the inter-individual difference**, we may notice that every being, according to the way it's built up, he'll have a different reaction, a different energetic level and an adaptability of his own. So this is the way we have to look at this reality of historical development.

It is therefore very difficult to classify things in this giant diversity of natural influences, cyclical actions, different response of the different beings to the same stimulus! It is really difficult if you want to reflect as wide as possible and clear the reality show of the Planet.

III. SHORT CLASIFICATION OF BIOLOGICAL RYTHMS

The biologic waves, the actions and motions have already been studied, checked up in the practical activities, but a common point of view still misses. They are even some kind of different opinions between the scientists. We will mention here that a classification of all these is just a didactical one, cannot include everything, and more than that

is improvable. And it also includes the opinions of very many authors. It is good to be known.

A. The irregular fluctuations (wavings)

These fluctuations are caused by internal or external forces and they are a quick response the being gives to these influencing forces. Most of them are unpredictable, out of our control, first of all because we cannot know them as a whole, how different they could act, where in the

environment they are produced, which are our limits, how everyone could react different to the same external actions.

E.g.

A.1. *Solar eruptions*, give birth to different reactions to the beings, to their psycho-physiologic parameters;

A.2. *The radiation emissions*, have also temporary influences;

A.3. *The intoxications* of large populations with the same quantities of poisonous substances give different reactions to different individuals;

A.4. The same medicine dose taken by different sick people give a different reaction. The stress has to be put therefore on the patient not on the sickness!

All these irregular biological non-cyclic fluctuations, could be considered momentary disturbing actions of the natural biological rhythms.

B. The regular fluctuations (cyclic)

Part of these actions have a temporary action, cyclical most of the time, Part of them are very cyclical, upon some authors, almost mathematic. That's why we call them like this.

The main criteria for these fluctuations in order to be classified, was the time period in which they act. The classifications depend of course of the scientists who studied them. We present below, a list, in fact a didactical point of view of cyclical fluctuations, we consider to be the most complete.

Halberg F., Reinberg A. and Hans E., mentioned by eng. Dumitru Mihalache present according to the main criteria mentioned above the following classification of the cyclical biological rhythms:

B.1. High frequency bio-rhythms from a few tenths of a second to round about 30'.

E.g.

B.1.a. *The rhythms of electric activity of the brain*, are in fact the rhythms of the neuronal excitability, having frequencies of 2,10 and 50 cycles/ second;

B.1.b. *The rhythms of enzymatic activity*, having periods of milliseconds;

B.1.c. *The breathing rhythm*, having a normal frequency of 20 breaths / min., some 3" when resting cycle, the amplitude and the frequency modifies according to needs of the body effort.

B.1.d. *The hearth beating rhythm*, at a frequency of 60-80 beats / min, also able to modify according to the needs of the body effort.

B.2. Medium sized frequency bio-rhythms, with periods from 30" and round about 2.5 days:

B.2.a. *Ultardian bio-rhythms*, having cycles between 30' and 20 hours. Some of them have periods of 80' and 160' and they think they depend of pulsating periods of the sun;

B.2.b. *Circadian bio-rhythms (circa diem)* means one day approximatively, in latin) periods between 20-28 hours;

B.2.c. *Infradian bio-rhythms*, between 28 hours and 2.5 days.

B.3. Low frequency, periods exceeding 2,5 days:

B.3.a. *Circaseptan biorythms (circaseptadian)* for the periods of 7+3 days;

B.3.b. *Circatrigintadiene rhythms*, periods of 30+- 5 days;

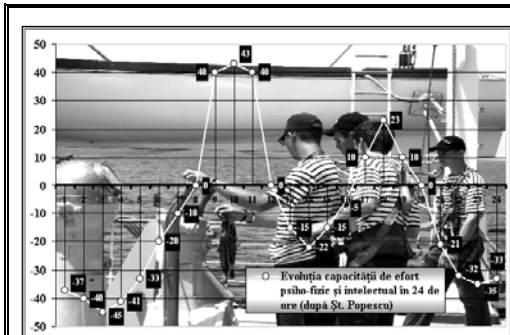
B.3.c. *Monthly bio-rhythms*, periods of 29.5 days as the moon does a complete rotation; *physical rhythm* of 31 days, *Intellectual rhythm* of 33 days and *emotional rhythm* of 28 days (including the menstrual the rhythm or the cycle of 28+-2 days);

B.3.d. *Season bio-rhythms;*

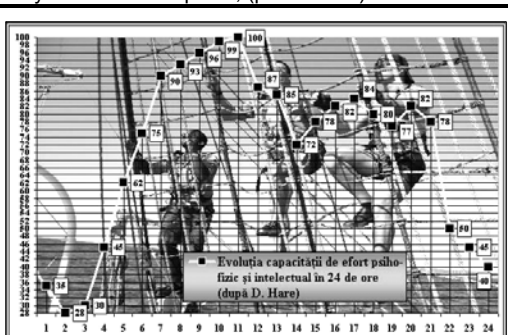
B.3.e. *Circa annual biorythms*, period of 12 ± 2 months;

B.3.f. *Multiannual biorythms*, periods of 11 years, determined by the sun activity.

Stefan Popescu is mentioning (1981) along 24 hours two apexes of highest level of human activity, every week, namely between 09.00-11.00 and 17.00-19.00, and two lowest levels, 13.00-15.00 and 23.00-3.00. As a conclusion, we may have now a graphic presentation of the *circadian* rhythm in the first plans, (plans no. 1).



Plans 1: The evolution of psycho-physical effort capacity in 24 hours (after Stefan Popescu)



Plans 2: The evolution of psycho-physical effort capacity in 24 hours (after D. Hare)

The same conclusions belong to the scientist D.Hare (see plans no. 2).

As we can notice the graphics of the fluctuation of the psycho-physical and intellectual effort of the human in 24 hours are very similar to the two scientists.

We present the following elements of analysis concerning the fluctuation of the bio-psychical and intellectual capacities of the body during the 24 hours of a day:

- the highest capacity is remarked in the morning, in comparison with the afternoon;

- the best performances from neural-psychical point of view are noticed in the morning, too. The physical ones, in the afternoon;

- the apex of the depression from 23.00 hours is lower than the 14.00 hours depression level;

- at 06.00 the body functions are at a higher level at the ones to begin the work than to the ones that are preparing to rest, or continuing the work;

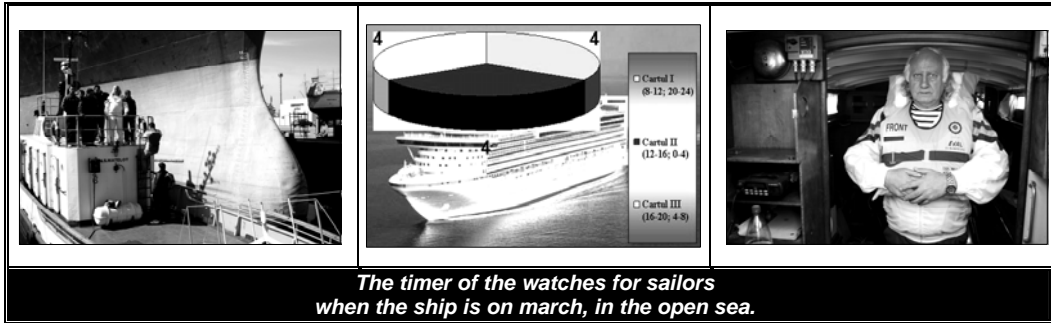
And if the body is older, at 06.00 than at 10.00, the performances are higher at 10.00 as an "effect of daytime";

- the age doesn't modify the circadian rhythm; anyway, at the older persons the amplitude of the performances as an effect of daytime is higher;

- the lowest capacities of the organism are situated during the night noticing a medium depression at 23.00 that became even lower towards 03.00 hours;

Taking into account this variation of body capacities during 24 hours, logically the activities should be planned to take place on the apexes of best shape. But the things can not be programmed this way, and we'll give an example.

In the navy, when sailing, the shifts of the watches are developing non-stop, changing every 4 hours when the ship is on march. The navigator in first watch will do his service on the deck or at the engines between 08.00-12.00, 20.00-24.00. the second watch will perform between 12.00-16.00 and by night 00.00-04.00 and the last ones the 3-rd watch between 16.00-20.00 and 04.00-08.00.



Obviously the night watches, suggests, a lower capacity of the body and there's an increased risk to make errors, mistakes and affect the general security of the navigation. This impose supplementary measures of security.

IV. THE NATURAL SYNCHRONIZERS, THE SOCIAL DETERMINANTS, THE SYNCHRONIZATION AND THE DESYNCHRONIZATION

There have been studies concerning the possibility to adjust the beings to react to the changes of temporary actions occurrent synchronizers, the biological rythms were balanced. We'll mention only two because of the lack of the space:

- a) when the individual is walking long distances on land;
- b) when the individual changes his daytime activity with a nighttime one.

In the navy the long distances are usual, and it wouldn't be a synchronization problem to adapt to this, considering, the sailors are having a non-stop rythm of work during 4 hours (4-work, 4-watch, and 4-sleep). When the ship is in anchor in a harbor, the watch service is 12 hours, and the synchronizers action the sailors the moment when the change the daylight activities with the nighttime ones.

V. THE CIRCADIAN BIO-RYTHMS TO THE SPORTSMEN

These aspects must be analyzed separately. We mention here only the fact that at the best recordmen, the best record are noticed in the morning (09.00-11.00), to the target shooting, neural-psychical activity, and in the afternoon

(17.00-19.00) in athletism, cyclism, rowing, sports with psycho-motional needs.

VI. THE MONTHLY BIOLOGIC RYTHMS AT THE SPORTSMEN

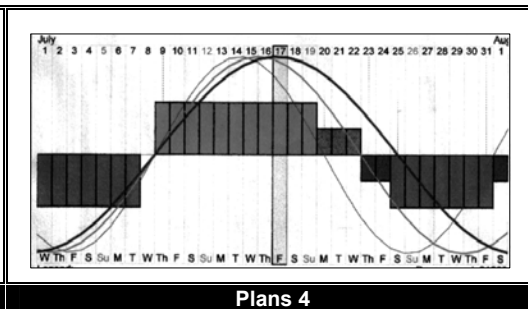
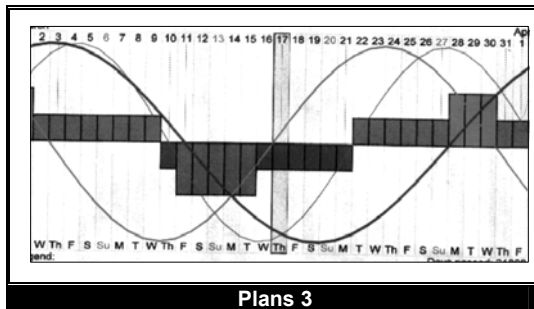
These ones must be analyzed separately, too. We'll present here only the experiment we made with our young sportsmen of the National rowing team and the sailors of academic rowing and kaiac-canoe teams of the Naval Institute „Mircea cel Batrin” from Constanta, an experiment that lasted along a few years.

We had the possibility to use the electronic calculations of monthly bio-rythm of the sportsmen, concluded that the presentation of the capacities levels of everyone calculated for the period of the contest, could strongly psychical influence motivating them, giving them confidence in the mselves.

I.E. If a sportsmen is seeing the real bio-rythms of himself for the 17-th day of the month (when the contest is taking place).

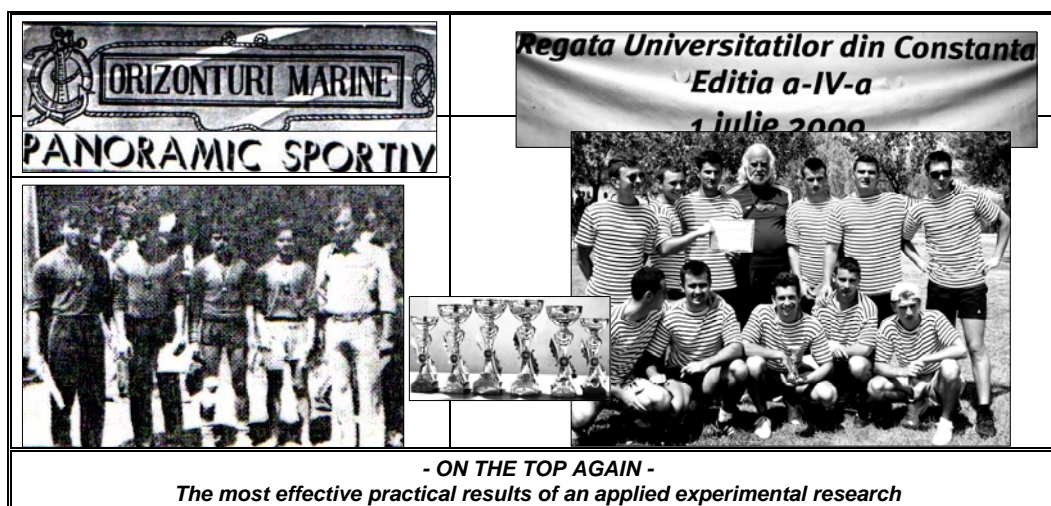
In the three plans, we presented (physical, psychical and intellectual), like in the Table no.3, he'll be totally dishearten, he'll attack the contest, psychologically influenced by his missing capacity, reflected by the computer's curves, for that 17-th !

Experimentally, we modified the day of the birth for the youngman (made a forgery, without he knew), we deleted the real date of birth from the sheet of paper we showed him, so his bio-rythm looked like plans no.4.



We do not have space enough here to present the level of psychological involmpt of the sportsmen and confidence they show, the magnificent results they obtained using this trick, and of course training them at highest level:

- the III-rd place (after Steaua and Dinamo) at the National long distance Championships, on Bega Canal, Timisoara;
- a bunch of gold silver and bronze medals at the Universities National Championships on the Tei lake, every year.



We'll be back, to present to you some other aspects in tight link with our applied researches on the theory and the practical activities concerning biological rhythms in order to improve the performances in sports.

VII. BIBLIOGRAPHY (REFERENCES)

A. Scientific Congresses on specific themes

*** „Biological clocks” - 1960; „Circadian systems” - 1961; „Circadian clocks” - 1964; „Biological Clocks in Medicine and Psychiatry” - 1965; „Cycles biologiques et psychiatrie” - 1967; „Symposium of Niht and Shift Work” - 1974.

B. Scientific works on the same themes or close

[1] OPRISAN Naie - „Checking and forming test, of the physical and psycho-motional specific capacities of the sailors, the evaluation of their real possibilities to act in fulfilling the ship role” - The work was communicated at the scientific session of the university professors at the Institute of Civilian Navy, on October the 29-30-th 1993. It was published at pages 89-90 in the book.

[2] OPRISAN Naie - „A model of rational type of organizing the practical activities of the students aboard ships and an objective appreciation manner in the practical activities” - communicated at the scientific session of the universities professors. Science University Timisoara November 20-th, 1993.

[3] OPRISAN Naie - „New study hypothesis concerning the theory and the practical activities in applying human biological rhythms” - communicated at the University Ovidius in Constantza on November 27-th, 1993.

PYGMALION MYTH

Marioara PATEȘAN¹

¹ Assoc. professor, PhD, “Nicolae Bălcescu” Land Forces Academy, Sibiu

Abstract: *Pygmalion story has been transmitted and represented in arts through the centuries. Myth represents initiating stories which tell us primordial truths and place us into a realm of transreality. The mystery and the unknown are amplified by man who tries to discover the truth. A myth is but a story full of wisdom which has real cultural, moral and traditional values. It carries with itself the mystery of the past and in the same time the desire to find out more about it. Such a myth is Pygmalion, the search for perfection, for beauty, for life, for immortality. In this study I will depict the myth of Pygmalion in Romanian and British literature, focusing on Shaw's play. Nichita Stănescu and George Bernard Shaw have different points of view when it comes to the theme of creation, love and sacrifice, but both strive for perfection in art.*

Key words: *myth, approach, creation, love, sacrifice*

The basic Pygmalion story has been transmitted and represented in the arts through centuries. George Bernard Shaw's Pygmalion owes something to both the Greek Pygmalion myth and the legend of king Cophetua and the beggar maid, in which a king lacks interest in women, but one day falls in love with a young beggar girl, Penelophon, later educating her to be his Queen. The legend of Pygmalion refers to the king of Cyprus and a great sculptor from Olimp who did everything to reach perfection. Pygmalion as a skillful sculptor made a statue of ivory so beautiful that no living woman came anywhere near it. It was indeed the perfect resemblance of a maiden than seemed to be alive and only prevented from moving by modesty. His art was so perfect that it cancelled itself and its product looked like the workmanship of nature. Pygmalion admired his own work and in the end fell in love with the counterfeit creation. He often placed his hand upon it as if to assure himself that it was alive. He could not or did not want to believe that it was only ivory. He cherished it and gave it presents as if it were a young girl he was courting. The festival of Aphrodite was a festival celebrated with great pomp in Cyprus. When Pygmalion had performed his part in the solemnity he stood before the altars and timidly said: “Ye gods, who can do all things, give me, I

pray you, for my wife” - he dared not say “my ivory virgin”-, but said instead “one like my ivory virgin.” Aphrodite answered to his pray and she gave life to the statue; after that he married his statue, now a living person.

In my study I will analyze two different approaches to this myth, of two different authors with regards to the theme of creation, love and sacrifice.

In Romanian literature our greatest poet Nichita Stănescu presents in *Către Galateea* his vision regarding the myth of Pygmalion. In this poem we see the creator speaking to his own creation while working at it. He tells his creation that he knows everything about her: shapes, shadows, gait, feelings, and secrets; he asked her to bring him to life thus giving him eternity. In this poem, Galatea is a statue made of stone, a great creation which means sacrifice, love and desire to create. If the beauty of creation depends on the force and skill of the artist, the immortality of the artist depends on the beauty and perfection of his creation, so the creator and the creation are born at the same time and they support each other. In this poem the creator does not beg the goddess for life, but his own creation. In the Greek myth, Pygmalion and Galatea –the ivory statue turned into the perfect woman– marry and have a son, Pathos, (suffering, passion).

Therefore, the pathos of an artist gives life to his art. Nichita Stănescu is inspired by this story in writing his poem. Galatea becomes a symbol of both the beloved woman and of the mystery of life. The poem presents the relation between the artist and his art, on one hand, and that between creation and time, on another hand. We witness a unique mixture: the Unborn Creator- Time and Galatea- the Creation- the Great Creator. The poem has symmetry given by the two verbs that begin and end each stanza: *to know and to beg* followed by an imperative: *bring me to life!* –the artist *knows* what to do to create a perfect work of art, and in turn his masterpiece gets the power to *bring him to life*. All along the three stanzas we sense a gradual degree of adoration of the artist towards his creation. He begs it to help him become a great artist by kneeling in front of it: „și nu mai am răbdare și genunchiul mi-l pun în pietre/ și mă rog de tine./ naște-mă”.

By striving to create the perfect creation the artist comes to leave reality and lives in his own artistic world: The real world becomes but a pale copy, a mimesis of his own reality “Știu tot ce e mai departe de tine, atât de departe, încât nu mai exista aproape-după-amiază, după-orizontalul, dincolo-de-marea și tot ce e dincolo de ele, și atât de departe, încât nu mai are niciun nume. De aceea-mi îndoi genunchiul și-l pun pe genunchiul pietrelor, care-l îngâna. Si mă rog de tine..naște-mă.”

Galatea is an artistic metaphor for love and art. It becomes a symbol of life that can put a print on the artist's existence, love and immortality. *The poet believes that “sensitivity as well as the work of art itself, once finished becomes part of the real world, becomes reality from the artist's point of view.”*[1]

The creator identifies himself with his creation as he knows it so thoroughly “Știu tot ceea ce tu nu știi niciodată, din tine”, both its past and its present:

“iti stiu toate timpurile, toate miscarile, toate parfumurile si umbra ta, si tacerile tale, si sanul tauce cutremur au si ce culoare anume,

si mersul tau, si melancolia ta, si inelul tau, si secunda si nu mai am rabdare si genunchiul mi-l pun in pietre si mă rog de tine, naște-mă.”

He is the only one that can hear its heart's beats and its words and as a true creator he can make it live as he has put his own heart/ passion in its coming to being, suffering a great deal during the process of creation. “Știu tot ceea ce tu nu știi niciodată, din tine, bătaia inimii care urmeaza bataii ce-o auzi, sfârșitul cuvântului a căruia prima silaba tocmai o spui...”

By achieving perfection the man becomes an Artist.

The same myth, but a different vision has George Bernard Shaw who actually sanctioned the mystery of the legend by creating a comedy. The play of *Pygmalion* is an appropriation of the famous story of Pygmalion in Ovid's *Metamorphoses*. Like all of Shaw's great dramatic creations, *Pygmalion* is a richly complex play. It combines a central story of the transformation of a young woman with elements of myth, fairy tale, and romance, while also combining an interesting plot with an exploration of social identity, the power of science, relations between men and women, and other issues. Shaw thinks that a playwright's aim is not to amuse an audience but to interpret life in all its complexity. In *The Interpreter of Life* he wrote: “But the great dramatist has something better to do than amuse either himself or his audience. He has to interpret life... life as it appears to us in our daily experience is an unintelligible chaos of happenings.” [2] The *Pygmalion* myth is fine when studied through the lens of centuries and the buffer of translations and editions, yet it is interesting to note what happens when one tries to translate such an allegory into 20th century Victorian England. That is just what George Bernard Shaw does in his version of the *Pygmalion* myth. The ideas in *Pygmalion* are not as profound as the ideas in any of Shaw's other major works. It can be considered an issue of language as “...an Englishman's way of speaking absolutely classifies him. The moment he talks he makes some other Englishmen despise him.”[3] The problem of language correctness crossed the ocean too. In John Steinbeck's novel *In Dubious Battle*, one of the characters says: “You know, Doc, men are suspicious

of a man who doesn't talk their way. You can insult a man pretty badly by using a word he doesn't understand. Maybe he won't say anything, but he'll hate you for it.”[4] George Bernard Shaw's play *Pygmalion* is the story of Henry Higgins, a master phonetician, and his plot to pass a common flower girl, Eliza Doolittle, as a duchess at the Embassy Ball. In order to achieve his goal, Higgins must teach Eliza how to speak properly and how to act in upper-class society. The play looks at middle class morality and upper-class superficiality, and reflects the social wrongs of nineteenth century England, and states that all people are worthy of respect and dignity.

Shaw's *Pygmalion* is Henry Higgins, a voluble professor of phonetics, who undertakes in a wager with his colleague Colonel Pickering to teach a cockney flower-girl, Eliza Doolittle, to speak English in an upper-class manner and transform her as to pass her off for a lady.

Eliza Doolittle is not a statue. She is a poor, illiterate flower girl, with an accent that would not allow her to achieve a better position, strong-willed and assertive. So, she might as well be a statue. She is non-existent in social circles, nothing more than a “draggle-tailed guttersnipe.” Her transformation takes place with the help of Professor Henry Higgins, who takes her on as his linguistic pet project and then does not want to let her go. He teaches her to speak properly, and he also trains her to act with more refinement. Eliza learns to expect more from life and from the people around her. She says to Higgins: “Oh, you are a devil. You can twist the heart in a girl as easy as some could twist her arms to hurt her.” She also learns that there's a price to be paid for her new-found language and refinement. She says, “Oh! if I only could go back to my flower basket! I should be independent of both you and father and all the world! Why did you take my independence from me? Why did I give it up? I'm a slave now, for all my fine clothes.”

In the end, all she wishes is kindness, and perhaps some bit of human compassion. She tells Higgins, “I'm not dirt under your feet.” Then, “I did it because we were pleasant together and I come—came—to care for you; not to want you to make love to me, and not forgetting the difference between us, but more friendly like.” Eliza appears to have learned more than she would have liked about society and human relationships. Higgins tells her, “If you can't stand the coldness of my sort of life, and the strain of it, go back to the gutter. Work 'til you are more a brute than a human being; and then cuddle and squabble and drink 'til you fall asleep. Oh, it's a fine life, the life of the gutter.” Eliza realizes that she is no longer fit for her old style of life and at the same time that she cannot adjust to the new way because of the cold, distant relations between people.” *You know I can't go back to the gutter, as you call it, and that I have no real friends in the world but you and the Colonel...*” Passing through all burdens she discovers her own beauty and the power to defeat her fear; she gains trust in her spirit and becomes an optimistic and courageous lady. Unfortunately she falls in love with Higgins who treats her with superiority and haughtiness.

She makes a promise to herself: if she does not have kindness, at least she will do everything in her power to keep her freedom. “If I can't have kindness, I'll have independence.” Higgins taught Eliza more than he even realized; that she should be proud of belonging to a great nation, that she possess everything to be more trustful in her own capabilities. Very early in the play, Higgins responds to Eliza's tears by telling her: “A woman who utters such disgusting and depressing noise has no right to be anywhere, no right to live. Remember that you are a human being with a soul and the divine gift of articulate speech, that your native language is the language of Shakespeare and Milton and The Bible. Don't sit there crooning like a bilious pigeon.”

This comedy surprises the story of a universal myth: the creator's love for his own creation not recognized by Higgins due to his pride. Another side of this theme is the story of Cinderella: a poor girl, Eliza Doolittle who is drawn out from a miserable life and transformed into a real lady from high society, capable of properly speaking and well behaving. The idea of this couple- a phonetics teacher and a poor girl- is based on the principle of mutual help. Within this relation

Pickering appears like a second creator, but who does not treat Eliza with haughtiness like her teacher and who considers Eliza a duchess, although she was a simple flower girl. The story of Pygmalion has three levels: a scientific one which includes the study of Eliza and her preparation in phonetics. Another one—that of recreating the myth of escaping real love by falling in love with your own creation; and a social one which represents Eliza’s room to the top of society, by changing from a poor girl to a potential duchess. G.B. Shaw stresses the idea of man’s desire to identify himself with his art.

Henry Higgins is Pygmalion from Greek mythology, the man who created through ability a consummate creation: Eliza. Creating his Galatea this Pygmalion needs her to be close to him, although at the beginning, he names her just a simple and difficult experiment. Because of his pride he continued to give her rough times and to tease her after her marriage to Freddy Hill. Incapable of loving but capable of twisting the girl’s mind, he realizes that Eliza wants to change her social and cultural position. This comedy does not follow the Greek myth as Higgins does not marry Eliza, preferring to remain a bachelor.

One of Shaw’s best works, *Pygmalion* is a perceptive comedy of wit and wisdom about the unique relationship between a spunky cockney flower-girl and her irascible speech professor. Eliza succeeds in passing the test when she is passed off as a great duchess at an ambassador’s garden party but she is given no credit by her creators. Not only have they ignored her contributions to the experiment’s success, but they have also put her in an awkward situation: she does not find her place into the world. With her new command of the English language she no longer fits back with her friends and because of her low birth will never fit in with high society. Despite her good command of vowels and consonants and nouns, verbs and sentence patterns she is not part “of the upper class”. [5]

Phonetics professor, Henry Higgins, believes that to be a lady means more than just learning to speak correctly. The central theme of *Pygmalion* is the gift of speech for human beings. Shaw has tried to depict how a person’s way of speaking properly affects their own personality and the people around. As a corollary to this theme, Shaw hoped to popularize the science of phonetics. In the short preface of the play, Shaw also makes a plea for enhancement of the English alphabet (with its too few vowels and few consonants) to make English reading pronunciation rational.

Both his wishes of popularizing phonetics and getting the English alphabet enlarged remain unfulfilled even today. Readers should resist the impulse to read romance into this didactic play where no romance is intended. Shaw believed that “all art at the fountainhead is didactic”. [6] Some say Shaw created a mouthpiece of his own ideas and the character of Eliza is the personification of these views. Bernard Shaw played two main roles in society before the publication of *Pygmalion*. Two of these may be linked to his creation of Eliza and Higgins. Firstly, his active role as a supporter of women’s rights, secondly his campaign for the simplification of spelling and the reform of the English alphabet as he believed that: *The English have no respect for their language, and will not teach their children to speak it. They spell it so abominably that no man can teach himself what it sounds like. It is impossible for an Englishman to open his mouth without making some other Englishman hate or*

despise him.” The two characters both represent his love for social action. Higgins character is not only extravagant but also comic. His passionate fondness for sweets and chocolates stands out in contrast to his seriousness and austere mode of living. He is constantly forgetting appointments, stumbling and tripping over something (Act 3 p 58) “*He goes to the divan, stumbling into the fender and over the fire irons on his way, extricating himself with muttered impatience on the divan that he almost breaks it*”. These lines and oddities of his character contribute to the laughs in the play and place Higgins in the tradition of the comic hero. Eliza on the other hand comes across as quite naïve, simple and sometimes quite ignorant. Her behavior is the result of a poor upbringing and lack of education. Eliza has a strong moral within her self and is also very ambitious.

The play ends with an uncertainty, whether or not Eliza will marry Higgins, however this is cleared by the epilogue in which he states reasons against such a commitment. The ending of *Pygmalion* is serious and in a way realistic, not at all in keeping with the light hearted and cheerful generic conventions of a comedy.

Therefore the audience cannot help but feel somewhat let down that their need for the fairy tale ending (the typical consummation of the love of the hero and heroine) goes unfulfilled. This was distinctive of Shaw, who was a lover of paradox, to have provided such an anti-romantic conclusion to the play. His own need to write a realistic and informed ending was more important as he believes that “the playwright is no mere *marchand de plaisir*, but ... a ruthless revealer of hidden truth and a mighty destroyer of idols.” [7] In his essay *Literature and Art*, Shaw defines the artistic work as a creation of the mind, of the soul” Literally, then, the work of the artist is to create mind real difficulty is to create your soul; and he can only do that by placing before you the picture of the world and the significance of it, so that you become, not merely a person possessed of accurate information, but in the largest sense a human being, which means to a certain extent a poet, a person susceptible to art.” [8] *Pygmalion* wanted to create his perfect companion while these two artists wanted to create a perfect piece of art. They did it in their own ways, according to their souls. Life is seen distinctly by various ‘minds and souls’; the two approaches although having a common core- the myth- are different. Nichita Stănescu’s heroine is a statue having all the features of a living beauty, while Shaw’s Eliza is a living creature turned into a sort of statue by her creators. The statue is offered the creator’s love, while Eliza is denied love. In the first case the creator has not found his artistic craftsmanship yet, so he can still offer love, while Mr. Higgins, the phonetics professor, masters his job so well he thinks he is perfect; thus he can offer no love, no life. A playwright “has taken on his supreme function ... (that of) ... the *Interpreter of Life* while a poet seems ‘to have said everything’”. [9]

Nichita Stănescu shares the same philosophy when he states that “Poetry is the happiest state of our soul.” And we should end with another quotation from the Romanian poet -“Let us not let some of our folks tell everything about an issue. Let us be generous. Let us leave the unborn the right to see with their *fresh* eyes ... what we saw with our *fresh* eyes.” (Journal 150-472) In other words let us leave them enjoy the pleasure of seeing or reading or watching these pieces of art and make up their own opinions, not follow ours.

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DATA WAREHOUSE OF A DERRICK - PART OF THE PETROLEUM PRODUCTION QUALITY MANAGEMENT SYSTEM

Loredana-Maria PAUNESCU¹

¹ Asist.univ.dr.d. - Department for Economical Mathematics and Informatics, Petroleum&Gas University, Ploiesti, Romania

Abstract: *The present work is concerned with the oil production which is a complex process. The main objectives are: the best administration of casualty stages of mains, the control over the level of accomplished production and the economic level of oil-field development tracking. The data warehouse procedure represents a new way of using important warehouses of grand dimensions that are useful in the development of a firm activity for a certain period of time. In the oil production activity and/or the gas production the use of the datawarehouse is a natural application because the process itself means the periodic canvassing and stockaging of certain data that can be used not only for the observation of derrick status at a certain moment but also for the prediction of its subsequent evolution and the prereception of any disturbance or bad maintenance.*

Key words: *activities, process, derrick, oil, objective, model, control, datawarehouse.*

1 The simulation of an oil – field exploitation

1.1 General aspects

The oil – field exploitation involves a series of activities, processes and macro – processes, some of them having as purpose the geologic – technical form preparation and logistics of exploitation and other processes are concerned with the drilling and crude oil production, transportation to the surface, oil storing, and primar treatment, intern convey to the distribution tank farm, the final water separation and associated gases, the oil production storage and measurement , the chemical treatment and oil- chemical

in special treatment stations of the natural product, conveyance and transport to the clients.

According to the concept of datawarehouse it is important to analyze the data obtained in the oil and/or gas exploitation process, in relation with other economic data related to the oil – field exploitation (conveyance costs, materials and repair/ replace parts etc.)

A deposit of petroleum fills a space that is designed at the surface on a bounded area. The oil – field exploitation is possible through derricks placed in concentric and rectangular networks (fig.1).

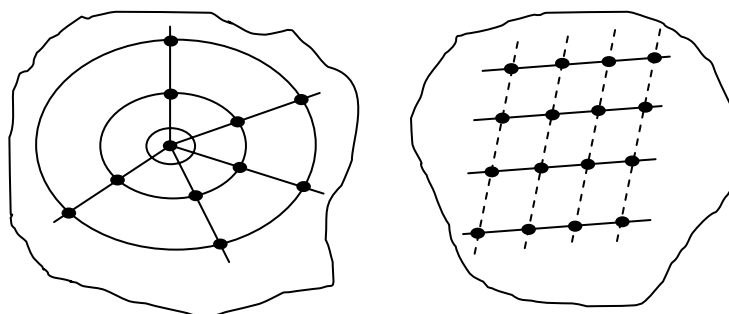


Figure 1. Oil – field exploitation through concentric and rectangular networks

For a good work in process control of exploitation and for a good knowledge of the product quantity excerpt, there is made a periodical controlled variable specific to the exploited derrick type (oil and/or gas). In this way we may obtain data concerning the fluid's preassure at the collar, it's temperature, date and hour for the measurement, the flow rate for a certain period of time (12 hours or 24 hours) etc.

The informational model of the petroleum deposit is presented in fig. 2 and we can observe the is made up of the following elements: data sources (derricks and/or other sources), convey data lines, equipments staroge (data base), data processing.

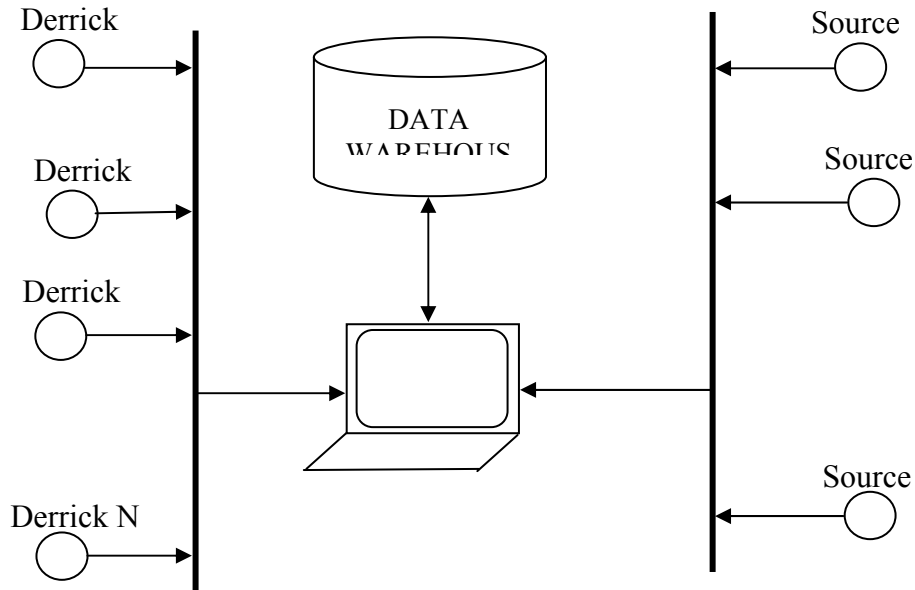


Figure 2 The informational model of petroleum deposit

The additional data sources have the origin from the auxiliary derrick activities, techno – economic activities that ensure the course of the main activity in the best conditions, of oil extraction and associated gases. The primar data will contain the specific production variables: pressure, fluid's temperature at the collar, the flow rate, the capacity of the pump spears, the pumping unit capacity etc. All these will be staraged in the data base just as they are noted, by direct reading or, most probably, by periodical automatic inspection

of certain sensors and the automatic insertion in the data base. The data for which there is no possibility for automatic recording at pre-set time cell will be introduced in the data base by human operators, according to the production reference or financial material.

The production derrick type as a system having the function of oil exploitation is describes in the following figure. By all means, this system is not isolated. But, it is a part of a superior hierarhical system along with others at such a level.

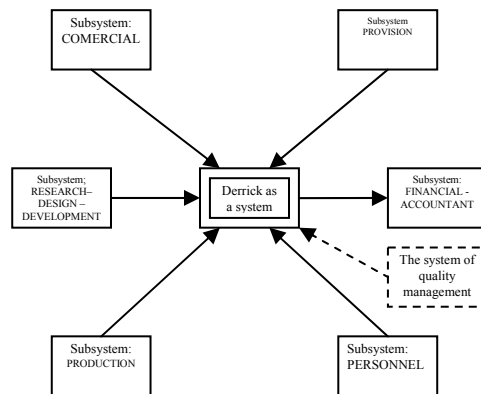


Figure 3 The production derrick as a system

According to the above data we may figure an automatic system for the surface production tracking, at the collar and the conveyance point for the beneficiary.

In the following main points of discution will be presented an automatic system for the oil production pursuitin which will be displayed a datawarehouse.

2. Type of automatic system for tracking the surface production.

As a rule, the presented model is available, with slightly differences, for the tracking of oil production that is accomplished at any derrick in our country. The model involves a network that permits global communication between different derrick locations, the communication with the main branch as well as the other derricks from the network.

2.1. The design of the automatic tracking system of surface production.

The tracking, at the surface, of obtained production is a complet precess that contains in its structure a series of elements/maesurements/parameters, variables, sometimes very difficult to keep under control. The ultimate goal of this proces is:

- A good management of pipes damage for fluids/products convey , including the damage due to theft attempt from this pipes ;
- The control over the periodic production obtained and accumulated and, the extraction factor ;
- The exploit limit reach and, of the final factor of recovery (f.f.r.).

In the folling lines will be presented in details the way that an automatic system accomplish these procedures.

2.1.1. The management of produc convey pipes in casualty situations

This goal is of a great importance because in casualty situations, regardless of the causes, can determine :

- the drastic oil production ;
- techinacal accidents (equipment) and sometimes human accidents ;
- the drastic damage of medium, sometimes causing ecological desasters with all the consequences that comes from this for the economic system of the derrick and finally for our country.

It is well – known that inside the pipes through wich the convey is made , inside the derrick (from de derrick o the

tank of separation, treatment, interphasic storage) as well in the exterior (for the central bulk plant and from here, to the oil refinery through the national oil transporter operator S.C. CONPET S.A. Ploiești, the movement has, in general, a stationary character, that means the movement parameters are invariable in time. It is possible though, that the pump pressure/ delivering under pressure to fluctuate in time and produce a change in the movement parameters (speed, capacity, pressure). In this case, for the estimating the flow parameters, it is considered that the unsteady movement is actually one unsteady bound state succession, the grade of proximity depending on the way it is divided the whole period of unsteady bound in the period of time when it is considered that the movement has a stationary character.

2.1.2. The production level control periodical and accumulated

The overall production is determined by the measurement of oil quantities (petroleum product) extracted from every production derrick, then, accumulate on a production tank farm, and after that the data being centralized

3. Data warehouse structure design

The data warehouse structure design must be take into account the specific aspects of the activity from the unity that requires the insertion of a date warehouse.

According to the ideas presented in the previous chapters, the activity developed at the extraction derrick's

at the level of production section and, in the end, at the derrick level.

The measurement of such quantities is made nowadays especially through the use of oil tanks from the storage oil farms where the extracted product is send after its primar treatment.

2.1.3. The tracking of economical exploit limit reach of oil deposit and, of the final factor of recovery (f.f.r.)

This goal is to be realized as follows:

- The correlation of data from de geological – technical research of petroleum deposit with data concerning the realized production after a long period of exploit, as well with the data of financial – costing run book concerning the costs of that deposit;
 - The following of the dynamics of such data and the stocking of data in a computer's data file;
 - The elaboration of the utility program account of petroleum deposit (potential) left after the achievement of petroleum production (also using the matrix from fig. 6 a, b, c);
 - The elaboration of the real final factor utility program of petroleum deposit recovery at certain periods of time.
- level is realized on one or more petroleum/gas deposits, through a certain number of derricks. This derricks can be, at a specific moment, in specific stages: in exploit, in operating repairs, broken, in preservation.

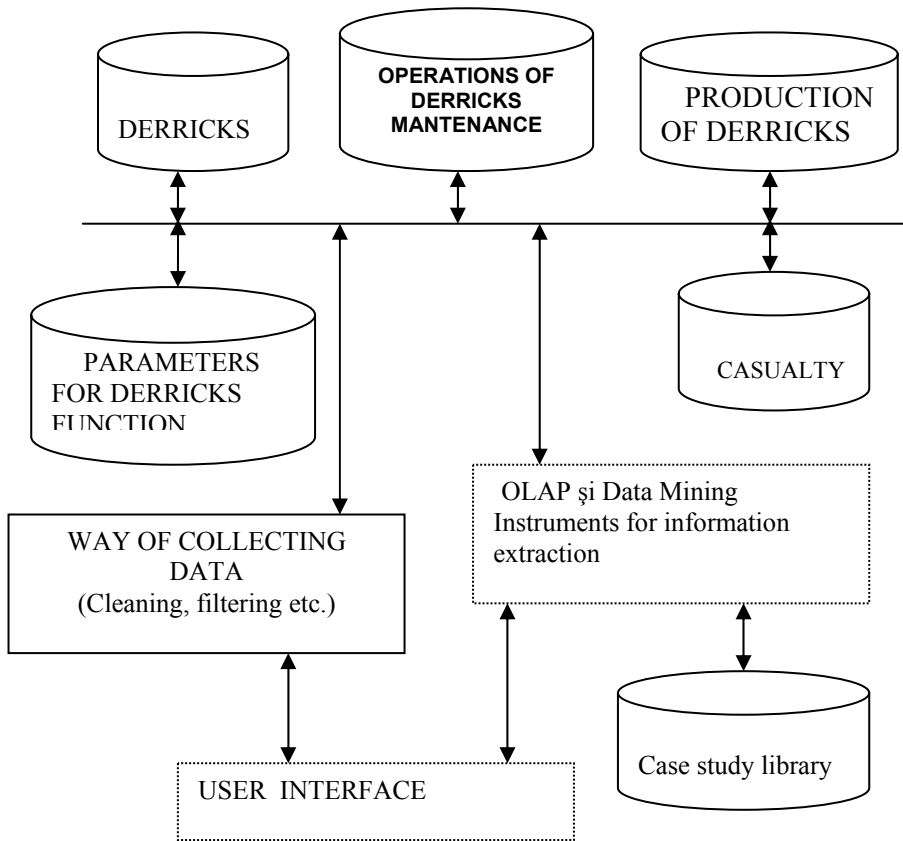


Figure 11. Data warehouse structure

At the data warehouse level the information is stocked in several data collections which batch the specific information of an analyzed field. These collections can be represented as one or several data charts (the relational model) or as a collection of objects (the objectual model).

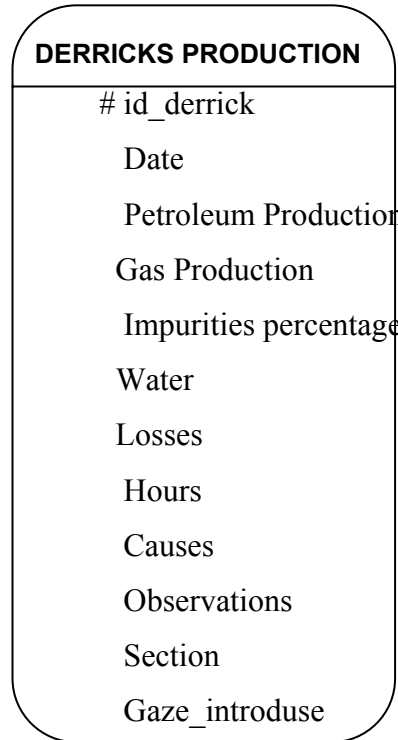
It must be mentioned the fact that when the relational model is used, the relation's normalization (the charts) utilized for the data collections is not to be done.

The structure of data collections that makes up the data warehouse is presented as it follows.

The DERRICKS collection contains specific information for a derrick: location, geographical position, depth, columns, column_munted drill, etc.

The DERRICKS PRODUCTION collection contains the recorded production for every derrick, values recorded day by day or at smaller lapses of 24 hours, but there is the possibility of automatic recordings.

The structure of DERRICKS PRODUCTION is presented as follows:



The PARAMETERS DERRICKS FUNCTION collection contains parameters measured at the collar (pressure, temperatura etc.).

The MENTENANCE DERRICKS OPERATIONS collection contains the interventions' run bookat the derricks, of maintenance or of casualty remedy, along with the used materials and personnel at specific activities. The purpose of this collection is to make an analysis of intervention costs on the derricks.

The CASUALTY collection contains the recording of all the casualties that appeared on the derricks or on the auxiliary equipments (derrick casualty, land equipment, transport pipes, pump chambers etc.), with the notation of the date, casualty and the solutions. We can observe that this structure is strictly referring to the direct data obtained from the production process. At all this, there will be added data from the economic activity for an analysis of real profitableness of the deposit exploit.

4 The data warehouse intergration with the automatic tracking system of land production and with the derrick's informatic system.

The data warehouse presented above must integrate in the informatic system of a company as well as with the tracking automatic system of land production.

To accomplish such a goal I present to you the following structure as shiwn in the next figure.

The communication between these 3 systems can be realized through an unique communication protocol.

At the network level will be used the TCP/IP protocol which is most used in the case of distributed network. The TCP/IP protocol has the advantage that for the location situated on long distances one from another is not recommended the appliance of an own line of communication and can be used an Internet connection.

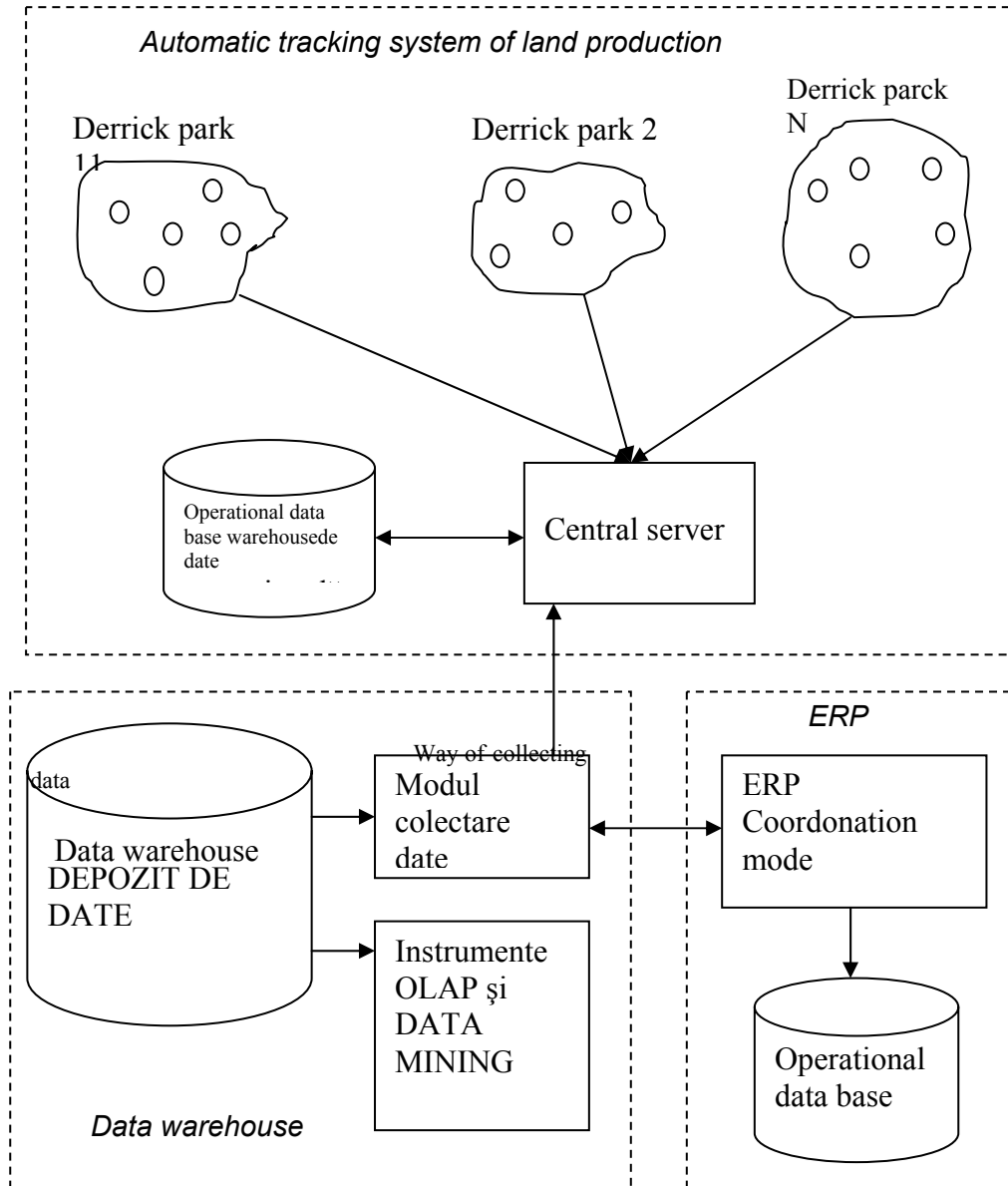


Figura 12. The data warehouse intergration with the automatic tracking system of land production and with the derrick's informatic system.

At a logical level, the data transfer between the 3 informatic systems includes the use of common transfer mechanisms. A current possibility of data transfer at a logical level between 2 different systems is the XLM diagram for data structure description. The XML code (eXtended Markup

5. The stored data processing for the petroleum deposit's exploit

The stored data in the data warehouse can be used for the following activity categories:

- The predefined report obtained through the OLAP technologies;
- The information extract for the derrick's function or the deposit evolution through Data Mining Methodes and techniques ;
- The extract information by request through SQL interrogation, according to the management team requirements;

The data processing from the data warehouse includes the following activities:

- The data filtration that must be introduced in the data warehouse. The purpose of this operation is the data

Language) is a descriptive code that allows the definition of new block (tags) according to the user's necessity. The advantage is that modern SGBD allows the data export/import in XML.

elimination that prove to be measurements errors and don't follow the trend of the measured quantity. Actually, this operation follows a similar procedure with:

1. The setting of analyzed value line.
2. The parameter calculation $\bar{x} = \frac{1}{n} \sum_{i=1}^n x_i$, where x_i is a measured parameter at the derrick (preasure, temperature, etc.)
3. We calculate the selection mean square value $s = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2}$
4. FOR $i=1 \rightarrow n$

- We calculate the v parameter for the value in the line x_i using the formula $v = \frac{(x_i - \bar{x})}{s}$
- For v calculated, from the tables we determine the α parameter
- If $\alpha > 0,1$ then,

The value of x_i is an error and from the line is eliminated

So, we skip to the next value in line

- The data aggregation from different sources. This operation means the transformation of data in a common format and their stocking in data collections from the data warehouse. The data aggregation can be realized at the data introduction in the data warehouse or when is required the extraction of new data from the data warehouse.
- The data extraction from the data warehouse through different ways. The most used way of extraction the information is the data collection interrogation using the SQL instructions. According to the work environment used for the data warehouse implementation the classical SQL instructions can be used (SELECT instruction) or complex instructions that allow the multidimensional work way (CUBE). Other ways mean the cube data when the work environment allows this processing or scanning Data Mining. The Data Mining techniques allow the information extraction from big data collections and they are: Techniques and statistic methods, techniques and specific methods of Artificial Intelligence.

6. Conclusions and recommendations for the implementation of a data warehouse in a petroleum

The datawarehouse technique is a new method of using large size data collections that can be accumulated inside a firm's activity over a considerable period of time.

It initially appeared as a technique for obtaining information with an economic purpose, useful in marketing research, on different markets and in different contexts, the datawarehouse technique developed along with other specific technologies (OLAP, Data Mining).

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- The report generation according the extract information. The reports can be presented as a text or as a graphic form or mixed. For the case of extraction of petroleum and gas deposits, an easy way of understanding the reports would be the map where will be represented the derricks and different technological elements (separation parks, pipes etc.).

An example of possible attainment of production at a certain date, structured on the derricks, on sections and on the whole derrick, is next presented:

```
SELECT id_derrick AS "Derrick ", SUM(petroleum production) AS " Petroleum Production ", SUM(Gas Production) AS "Extracted gas quantity ", SUM(Percentage of Impurities ) AS "Impurities", SUM(Water) AS "Water", SUM(Losses) AS "Losses", SUM(Inlaid Gasses) AS " Inlaid gasses"
FROM DERRICKS_PRODUCTION
WHERE Data = CURRENTDATE
GROUP BY CUBE (id_derrick, section) ;
```

The result will be displayed as a chart containing on the first line the production sum or the losses for all the derricks, for the entire scaffold. On the next lines will be displayed the subtotals on sections and derricks.

If there will be used another dialect from the SQL then there will be also used another clauses for the cross interrogations that are offered by the BY CUBE clause for the case of the SQL from Oracle.

Another results will be obtained from the data warehouse using similar interrogations or programming facilities offered by PL/SQL. This is an Oracle owner language that combines, along the SQL classical instructions, the programming instructions and a series of particular instruments (triggers etc.)

For the petroleum and gas field the use of datawarehouse means a normal, natural application because the process means collecting data, stocking data that can be useful for a number of reasons as, the knowledge of a derrick's state at a certain moment, its evolution and the forecast of any damage or maintenance problems.

The advantages of such approach are given by the strong integration of data obtained in diffent points, at large geographical distances, and obtaining manual processing of additional data from the production can be a hard, time waisting process, almost imposible.

THE FUTURE OF ENGLISH IN A GLOBAL WORLD

Oana-Andreea PIRNUTA¹

Adina TUDORACHE²

Ioana Mihaela DINESCU³

¹ Oana-Andreea Pîrnuță, Senior Lecturer Ph.D. TRANSILVANIA University of Brasov, Romania

² Adina Tudorache, TRANSILVANIA University of Brasov

³ Ioana Mihaela Dinescu, BUCEGI Mountain Training Base Predeal – Romania

Abstract: *The present paper aims at analysing different scenarios of the future of English in a global world and exploring the impact of global factors as demographic shifts, economic globalisation, financial trends, global inequalities, technology advancements, international communication on the future status of the English language around the world. The complex mix of material and cultural trends analyzed in this study will shape the global destiny of the English language and will determine a linguistic future of the world, which is more complex and less predictable than the majority believe. This paper offers a view of the linguistic future of the world.*

Key words: *English, linguistic future, global world, global factors, ELT.*

1. Introduction

The imperialistic status of English is shaking in the uncertainty of upcoming social and economic global changes. It explores the possible long-term impact on English of developments in communications technology, growing economic globalisation and major demographic shifts.

The complex mix of material and cultural trends will shape the global destiny of the English language and will determine a linguistic future of the world, which is more complex and less predictable than the majority believe.

While it is common knowledge that English has been regarded as the global language of the 20th century, few

people imagine that its status will be changed in the upcoming decades.

The world is in a transition with numerous tendencies emerging, the world being in the early stages of major social, economic and demographic transition. English may not be totally displaced as the world's *lingua franca*, but it might face the end of its monopole and the start of a pluralistic stage.

Languages other than English are likely to achieve regional importance whilst changes in economic relations between native-speaking English countries and other parts of the world will determine new reasons for learning and speaking English.

2. Foreseeing a Future for English

For some time now, English has been regarded as a global language, but the question is whether it is going to maintain its supremacy in the 21st century. Although at present the decline of the English language as a global language might seem unlikely, the future is more complex and less certain than it looks at the surface. Nowadays, English is the language of capitalism, of international commerce and trade, of global communication, of science, technology and cultural globalisation, thus, the position of English as a world language may seem untouchable. There is no immediate danger lurking around the corner for the global popularity of English, but it would be naïve to believe that significant global changes and trends in politics, economics, technology, demographics and culture will not affect the position of English as a world language.

English will take new forms according to the changes that occur in the world, a process that the English language has experienced ever since its appearance, adapting after contacts with other languages, changing according to communication needs and developing its own character by reflecting the local cultural and linguistic traits. It is also worth to notice the fact that *'within a decade or so, the number of people who speak English as a second language will exceed the number of native speakers'* [5].

This shift may have profound consequences, taking into account that the native speakers will become a minority, their global English language culture will not be the focus anymore and their model of English will not be the unchallenged standard language for learners. But the future for English will be a complex one because there are contradictory trends and tendencies: on the one hand, using English as a *lingua franca* means maintaining a certain standard of the language, but on the other, the increasing number of English as a second language speakers lead to the development of local variants of English, 'New Englishes' that are diverse and fragmented.

Making predictions about the future of a language is not easy, as it is shown by linguistic history: during the Middle Ages it was unthinkable to foresee the death of Latin as the language of education, or in the 18th century to predict the decline of French as the language of high class society.

Thus, the question is what factors could determine a shift in the global status of English?

One possible scenario developed by Crystal (2003) is the rejection of English [4]. This attitude towards English is a plausible one that fits the countries that consider the necessity of rejecting the privileged status of English, either as an official language or as a foreign language. This kind of antipathy can belong to former colonies which have a strong reaction against the continuous use of English and a positive reaction towards the promotion of indigenous languages, as Gandhi who considered that to give millions knowledge of English is to enslave them. But in the post-colonial age, the majority of former colonies of the British Empire has maintained English as an official language with the exception of a few countries which have distanced themselves from the English language, like Tanzania where Swahili is the only national language and Malaysia which gave Malay the sole status.

On the other hand, several countries, which have been part of other colonial empires, have given English a special status, like Algeria, a former French colony, which has opted to make English its chief foreign language in schools, replacing French. Crystal (2003) talks about an economic reason that could determine some countries to invest more in local *lingua francas* that operate more on a regional level rather than at a global level like English does [4]. This is the case of the Spanish-speaking countries of Latin America that could back up Spanish instead of English, the case of countries of North Africa with Arabic, Hindi, Russian and German in other parts of the world.

Another reason that can account for the rejection of the English language is the animosity towards the USA. This is possible because 'Americanisation' and the McWorld culture are usually associated with the use of English, which is the main language of cultural globalisation, of the Internet, movies, television and music. Many people consider the fact that the American culture is a homogenizing force that threatens national and local values, and with it, the English language is regarded as the enemy of linguistic diversity, although in many countries English is only a foreign language and does not have enough influence to destabilize a national language.

3. Global Trends which Influence English

The world has entered a new phase where economic, technological and demographical changes will

transform societies and the traditional balance of power between the west and the rest of the world. The perspective of a new cultural, economic and linguistic landscape can be

reflected in the global trends, which interact with each other in complex ways and will shape the future of English. These global trends are analyzed in Graddol's book entitled *The Future of English* [5].

3.1 Demography

The future of English is linked to the answers of several questions that Graddol (1997) asks: how many people will there be in 2050?, where will they live?, what age will they be?, and more importantly, who will speak what languages in the 21st century? The world population is expected to grow, but the population trends will differ from country to country. The idea that population growth is slowing in European countries, whereas in non-OECD countries the population is increasingly becoming younger, leads specialists to see regions with increasing youth like Africa, Asia and South America as the main linguistic trend setters. A demographic estimate of first-language speakers for 2050 shows the fact that 1,384 billion people will be speaking Chinese, 556 million will have Hindi/Urdu as their first language, while the native English speakers will be approximately the same number as the Spanish and the Arabic ones, around 500 million. The migration trends of the 21st century will also have a great impact on the evolution of world languages. The three kinds of migration that Graddol (1997) mentions are the migration from poorer countries to the richer ones, migration within economic blocs such as the EU, and migrations within countries towards areas of economic growth [5].

According to the US Commerce Department's Census Bureau, by 2050, the immigration phenomenon may leave a barely majority of the 'white' population (quoted in McRae, 1994) changing the percentage of US citizens who are first-language English speakers [10]. Another demographic issue that will influence the future of English is the expansion of the middle classes in Asia and Latin America because according to Schwartz and Leyden (1997) the professional middle-class people are the ones that are most likely to adopt English as the language of their homes [14].

3.2 English and the World Economy

Economic relations have an important role in establishing the popularity of different languages. If economically strong countries determine the interest in languages, then the weakening of English-speaking countries will lead to a reduction in demand for English. Graddol (1997) considers that in international trading, the selling must be carried out in the customer's language [5], which leads to the idea that language popularity will follow trade demands. Thus, a language depends less on the GDP of a country and more on how native speakers trade on the international market.

In the business area, English is recognized as a *lingua franca*, but Hagen (1993) found that although English dominates as the language of business in Europe, German is also extensively used in business communication, especially in parts of central and eastern Europe. He concludes by saying that 'a minimum level of linguistic competence for a European company is the ability to perform in three: namely, English, German and French' [7]. As the patterns of trade change, it is highly possible that the language patterns may change, which means that the future of English as the language of business might be linked to the possible development of other important trade *lingua francas* in Asia and Latin America.

3.3 Technology Shapes the World

Technology has proved over the years that it does have a profound impact on language and culture and the status of English today proves it by having been shaped by the effects of the industrial revolution. It seems that today, English is strongly connected to institutional and social change brought by technological advancement like computers and communications. Computers and English have always seemed to belong together due to the fact that computers and their programmes are mainly the initiation of English speaking countries. Nowadays, the language restrictions tied to the computer software and hardware are becoming characteristics of the past, and the same case is quickly applying to the use of languages on the Internet. It seems that

the proportion of Internet users who have English as their first language has been decreasing fast, from 51.3% in 2000 to 32% in 2005, the Chinese language having grown the most in five years from 5.4% to 13%. The same decline goes also for the language of the web component, which has dropped from 85% in 1998, to 72% in 1999 and to 68% in 2000 according to Graddol [6].

A possible end to the domination of the English language on the Internet is foreseen by an analysis published in November 2005 by Byte Level Research, which concluded that the next Internet revolution will not be taking place in English, not because English is becoming less important, but because other languages such as Chinese, Spanish, Russian and Portuguese are becoming more in demand. What started out as an Anglophone phenomenon is now turning to a multilingual issue.

3.4 A Borderless World

Just as globalisation represents a string of flows and counter-flows, a tension between the global and the local, the English language comes into contact with other languages that adopt English words and phrases, but it is also influenced by local languages, leading to the creation of hybrid language varieties. According to Appadurai (1990), the world is not merely made of static entities such as 'cultures', 'nations' and 'national economies', but of five global flows [1]: *ethnoscapes* (people moving), *technoscapes* (technology transfer), *finanscapes* (flows of capital and currency), *mediascapes* (flows of audio-visual products, but also of their images and symbolism) and *ideascapes* (flows of ideas and ideologies).

People are always on the move, whether for education, business, as tourists, workers, immigrants, refugees or exiles. International travel seems to have the greatest impact on the use of English because people are brought together in a global world filled with interdependency and close communication, uniting people from different linguistic backgrounds and determining the need of using a common language. However, while passengers who move between different regions as the U.S. and Asia, for example, may use English as the language of communication, travelling inside a region will encourage the use of a regional language, like Mandarin when moving from North East to South East Asia.

Communication flows via Internet or telephone are also influential factors in terms of language. It seems that English is the dominant language of intercontinental communication, probably because of the massive traffic between English-speaking countries and other parts of the world. But as communication infrastructures improve especially in certain parts of the world as China, Indonesia, Singapore and Malaysia, more telephone conversations around the world will be held in languages other than English. When it comes to the flows of finance, Graddol (1997) believes that growing intraregional trade and financial dealings amongst Chinese-speaking business representatives will strengthen the status of Mandarin or Cantonese as a regional *lingua franca*.

3.5 The Role of English in Global Inequalities

Phillipson observes the fact that many people regard English as a language of power, success and prestige: 'The global language can be seen to open doors, which fuels a "demand" for English. This demand reflects contemporary power balances and the hope that mastery of English will lead to the prosperity and glamorous hedonism that the privileged in this world have access to and that is projected in Hollywood films, MTV videos, and ads for transnational corporations' [13].

If English opens doors to those who learn it, those who do not have access to it are deemed to have fewer opportunities and be poorer than those privileged? In other words, poverty which was in the past determined by factors such as geography, class, gender and ethnicity is now dependent on whether there is access to the *lingua franca* of the global elites.

The majority of people see the acquiring of English as essential for progress, because it will facilitate the access to high-tech communication and information, but there are

different views when it comes to the idea that English also leads to negative social consequences. Some do not believe that competence in English encourages elitism and increases socio-economic inequalities, but English can be regarded as a tool of discrepancy between ‘urban and rural, developed and the developing, elites and masses’ according to Pattanayak quoted in Coleman [11].

Also, being proficient in English is a must in order to have access to certain opportunities: sometimes acquiring certain jobs, applying for a foreign university or submitting papers to international journals depend on having an examination certificate or being a native or fluent speaker of English. The issue of social inequality also relates to the role of English in the education medium of post-colonial countries, such as India and Malaysia where English is an instrument of

4. English in the Future

One of the main topics debated in the specialized literature today is whether the current standards of English (British and American) will continue to represent the utmost correctness, whether another standard form of English will develop instead, which will be used for the purpose of international communication and teaching, or English will be fragmented in various local and regional forms. On one hand, English as a *lingua franca* promotes the idea of linguistic uniformity as a guarantee for mutual intelligibility, on the other hand, the increasing status of English as a second language is leading to the development of a large number of local varieties. This is happening because English is not only the language of international communication which requires common standards, but it is also a part of different cultural identities, and as its first function becomes more and more widespread, more and more communities integrate the English language in their cultural identity.

An important part in maintaining an international standard is played by the ELT industry as Stevens suggests: ‘*There exists an unspoken mechanism, operated through the global industry of ELT teaching, which has the effect of preserving the unity of English in spite of its great diversity. For throughout the world, regardless of whether the norm is native-speaker or non-native speaker variety, irrespective of whether English is a foreign or a second language, two components of English are taught and learned without variation: these are its grammar and its core vocabulary. (...) the grammar and vocabulary of English are taught and learned virtually without variation throughout the world*’ quoted in Kachru [9].

Still, this standard of English can be replaced in second-language countries by promoting national varieties in teaching English and creating non-native models of English supported by non-standard pedagogic materials. Thus, it might be possible that different standards will be competing against each other on the market of ELT.

English will not be faced only with an inside competition between various standards from second-language countries, but also a rivalry with different emerging languages. Graddol (1997) believes that there is probably no reason to think that another language will achieve the status of English as a *lingua franca* in the next 50 years [5], but there is a clear possibility that no other language will have in the 21st century the same monopole that English had in the 20th century. In this perspective, a small number of world

5. Conclusions

This brief overview of the foreseeable future in terms of world languages tries not only to predict the future of English, but also of possible global trends that might propel other languages as rival languages for English and possible *lingua francas*. It shows the fact that foreseeing is not an easy job when it comes to global changes, because they depend on numerous factors as demographics, economic and financial trends, global inequalities, technology advancements and international communication. After having analyzed different scenarios, nothing can be taken as a matter of future

distributing social and economic power. In such countries, English is viewed as a means to economic success, but because of the fact that teachers are not fully proficient in English and this language is not so used inside the communities, learners can benefit only from a second-rate education. English has an important role in the extent of endangered languages. The reduction in linguistic diversity is the result of global demographic and economic trends in which local cultures and languages are disappearing as a result of their limited political and cultural power. Graddol (1997) believes that English is not the main or direct cause of this language loss [5], but due to its global status and association with social and economic changes in developing countries, it is very likely that it is made a target by those protesting against the loss of cultural and linguistic diversity.

languages will have control over particular spheres of influence and regional bases.

The economic activity, air travel and telecommunications between different parts of the Asian continent are greatly increasing and outnumbering the flows between the USA and Europe. This can lead to three possible scenarios.

The first one is that English will maintain its privileged position in Asia because its representation of power and elitism is too enrooted to be thrown away. The second scenario views Mandarin as the language preferred as a *lingua franca* in the region of Great China, while the third one sees no single language reaching the status of a *lingua franca* and a greater number of regional language will be used in international communication. Another problem of prediction regards the rising of Spanish with the emergence of trading areas as MERCOSUR (Southern Common Market), SAFTA (South Asian Free Trade Area) and NAFTA (North American Free Trade Agreement), which together with the rise of the Hispanic population in the U.S. will lead to the forming of a bilingual English-Spanish zone in the Americas.

The effects of economic development and globalisation are felt in many countries, and as a consequence, substantial language shift will be likely to occur in the next 50 years. The loss of at least 50% and as much as 90% of the world’s languages means that the remaining languages will acquire new native speakers fast. Languages higher in the hierarchy will be the ones benefiting the most, whereas regional languages will become more diverse while integrating more diverse speakers and developing more functions for its speakers.

English will benefit from the economic development, leading to the enlargement of the middle class, which is the most likely to acquire English as the language used both in the professional life, but also in the private sphere. In countries, which have English as a second language, English might even be preferred as a first language by the upcoming generations due to the English oriented medium of education as in India and Nigeria.

English might maintain its status as a global engine of change that encourages small communities to embrace the language of international communication, but other languages as Hausa and Swahili in Africa, Malay, regional languages in India, Russian, Mandarin and Arabic might benefit the most because of their larger numbers of native speakers.

facts, but there are present tendencies, which are sure to continue, like the economic and demographic developments of certain areas which will lead to the climbing in language hierarchies of languages such as Chinese, Hindu/Urdu, Spanish and Arabic alongside English. The biggest difference between the present day language rankings and those of the future will be the outcome of the disappearance of several thousand languages around the world. Thus, the shift from language monopole to the oligarchy of several world languages stands not only for pluralism, but also for a loss of diversity.

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OPERATIONAL SOLUTIONS FOR IMPROVING THE QUALITY OF MILITARY EDUCATIONAL MANAGEMENT

Cătălin C. POPA¹

Filip NISTOR²

¹ Major, Lecturer, Naval Academy „Mircea cel Bătrân”, Constantza, Romania

² Captain, Professor Assistant, Naval Academy „Mircea cel Bătrân”, Constantza, Romania

Abstract: *This paperwork is meant to treat some stringent problems and difficulties in educational processes management within military institution, starting with the study of complex challenges in economical and social changes dimension, defined in relation with the most recently tendencies on labor market. The authors reflected as a conclusion that the incentive of teaching and educational training quality of in military area should be built on the concept of military social values improvement, as a work hypothesis before any strategy design. The educational process should be oriented, as civilian teaching system, toward student, in the center of its rationality based on knowledge society principle.*

Key words: *management, educational processes, military institutions*

In the Bologna context, the military educational process is facing the complex challenges of economical and social changes, defined in relation with most recently tendencies on labor market. The main ways for improving the educational processes within military organization should be based around some strategically and operational pillars. The coherency of proposal is not important, in fact the most relevant aspect for an inflexible institution being the initiation of change processes. The quality incentive of teaching and educational training in military area should be built on the concept of military social values improvement, as a work hypothesis before any strategy design. The educational process should be oriented, as civilian teaching system, toward student, in the center of its rationality based on knowledge society principle. In this perspective, we have suggested below some measures for military educational strategies improvement.

First, for training and educational targets fulfillment, Ministry of Defense should establish not only the minimal criteria for military graduates' profile but the percentage associated with desired projected competencies as well. The planning process should be divided distinctly on training phases, according to the military carrier guide. In this manner it will be possible to design, besides specific knowledge and abilities, a set of transversal competencies for graduates that will make a compatible connection between military and civilian qualifications. The competencies and abilities projected on professional evolution for military personnel will be adapted in this case, dynamic, both to the specific internal labor market and external labor market.

So, in order to accomplish these desiderates it should be promoted those knowledge, abilities and competencies with multiple valences both in military and civilian domain of activity, for the increase of labor force mobility of military personnel. The mobility in military evolution will offer a positive image of an „open carrier”, making attractive the option the military carrier itself. The mobility will offer also a new comparable set of criteria between two different system of education civilian and military.

Military system has to create a dynamic system for educational curriculum projection, such as to assure an flexible graduates profile, connected and full dedicated to both to military realities but to the changes in civilian labor external market as well, keeping the teaching acts in permanent relation with last technological, economic, cultural or political tendencies or changes.

In other idea, teachers from the military system should be trained through specific application programs in practice dimensions of their specialty, periodically, in the spirit of main operational knowledge maintenance. This perspective will improve the practical dimension of teaching courses, coupling the theoretical discourse with the instrumental area of effective application, transforming the knowledge in real correlated abilities, useful on territory.

In this direction is recommended the incentive of institutional involvement in international cooperation programs together with military universities, stimulating the multilateral dialog in area of educational area. The cooperation processes will stimulate the knowledge harmonization based on NATO procedures. It will offer as well the perspective for growth of military values appreciation, gaining additional recognition features in social and cultural dimension. The military international activities if will imply educational system will start to develop a tradition in value interactions making possible the building of a professional well recognized culture.

Regarding didactics methods and instruments used within military superior education system military institutions of education have to achieve modern mutations in relation with knowledge economy principles, through teaching methods based on actional dimension (study cases, problems solving and learning through discovering), team teaching or using of modern techniques in teaching acts. Together with these the education system will benefit from the new attitude regarding the active teaching principles, practical perspective over the knowledge, blending the individual learning procedures with group intelligence methods of learning. Actually the educational system is oriented toward information gathering and communication exclusively in one way, from

the teacher to the students. The new concept of education around the European countries takes advantages from the new concept based on changing the accent interest from information delivering to competencies building-up, as the main objective of teaching programs. Taking under consideration the professional criteria within military organization, the optics of competencies achievement priority becomes one of the most important strategies toward a high quality system improvement in military educational system.

On the other hand, in the presence of a growing competition in area of educational field, Ministry of Defense has to think strategically and innovator, in the direction of educational system autonomy assurance as a short term priority. In this moment the military universities are outside of autonomy general civilian principles, this situation making impossible the corresponsive dynamics in research or in accomplishments in educational marketing, the competitiveness being directly affected by the systemic inflexibility. In military educational system the subordination is multiple, the decision being in fact a result of too many leading structure, one of them having nothing to do with educational or training activities. So the excess of command chain in education management has a negative impact over the particular decision policies within educational system, proved by its inflexibility. The decision of educational management has to be efficient, operative and enough opportune in relation with educational processes.

In this respect, the military system should be attached and fully integrated in national educational system through promotion of civilian specializations, which will complete the image of complexity of military carrier, seen not as an isolated personal development process. We can't ask for social recognition as long as we promote values inside the system and as long as we stress the importance of team spirit stopping from the beginning any individual assertion. The candidates coming in military institution are accepting the system conformity before individual performance, the education being focused on organizational values and

principles against personal development. But on organization will be recognized outside as valuable in major situations, through individual qualities of its employees. So the educational military system should be oriented toward student and not toward the complacency of conformity organizational principles, for improving the image of our graduates on the external market labor.

Underlying these observations, before starting the educational system management improvement, the military institution should create a positive perception above military phenomena at least regarding military carrier as an open carrier, based on some coherent measures focused on individual satisfaction items, as follows:

- building an informal profile (not only formal) of military personnel categories distinct in services and ranks, for modeling the personal perception of new entry graduates based on the successfully carrier models;

- the development of military values should be connected to the civilian axiological principles, from the hypothesis of blending the competencies (knowledge and abilities) both on civilian and military dimension, based on transversal competencies;

- encouraging the real competencies promotion principle in military carrier, for a reasonable individual value recognition stimulation;

- implementation the respect of the subordinates rights not only the obeying of punitive obligations – the “*commanders’ institution*” should be transformed back in “*militaries’ institution*” understanding through this the prevail of personal engagement, responsibility, collective control and evaluation

- active participation of individuals in group life and in social activities, being important the coherent harmonization of individual interests with organization objectives – the institution should be interested by its employees problems and, in this respect, it is necessary to work out the conciliation procedures on functional and efficient basis;

Conclusions

The military educational system should be a real promoter of military values on the external labor market through professional qualities of its graduates. The competencies, knowledge and abilities of its graduates can prove, in terms of personal success, the real value of military

carrier on labor market. The military institution should start the social perception reform from the military educational system functional and architectural rethinking. The training processes will be oriented toward student as priority and the weight center should be moved on abilities and competencies instead of information communication techniques.

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THE NEW RELATIONS BETWEEN GLOBAL ECONOMY, INTERNATIONAL TRADE AND FINANCIAL SYSTEM

Cătălin C. POPA¹

Haralambie BEIZADEA²

¹ Major, Lecturer, Naval Academy „Mircea cel Bătrân”, Constanța, Romania

² Professor, PhD, Naval Academy „Mircea cel Bătrân”, Constanța, Romania

Abstract: *The new tendencies of global economy can be more efficiently detailed, explained and understood, on the base of those internal functional relations established in contemporary economical global dimension, between economy, international trade and monetary-financial system. Starting with the idea of a new economies’ typology will be clearly possible to analyze the mechanism of international return results in relation with trade dynamics connected to the new particularities of international monetary-financial system. This paperwork brings into discussion the equilibrium principles regarding the global economy functionality in the presence of integration and globalization phenomena. Continuing an old author’s theory, the paperwork studies in a synthetic manner the interstitial ties between a new typology of economies (as has been treated in previous scientific papers) and financial system as being the main way in harmonizing the global equilibrium.*

Keywords: *global economy, financial system, international trade*

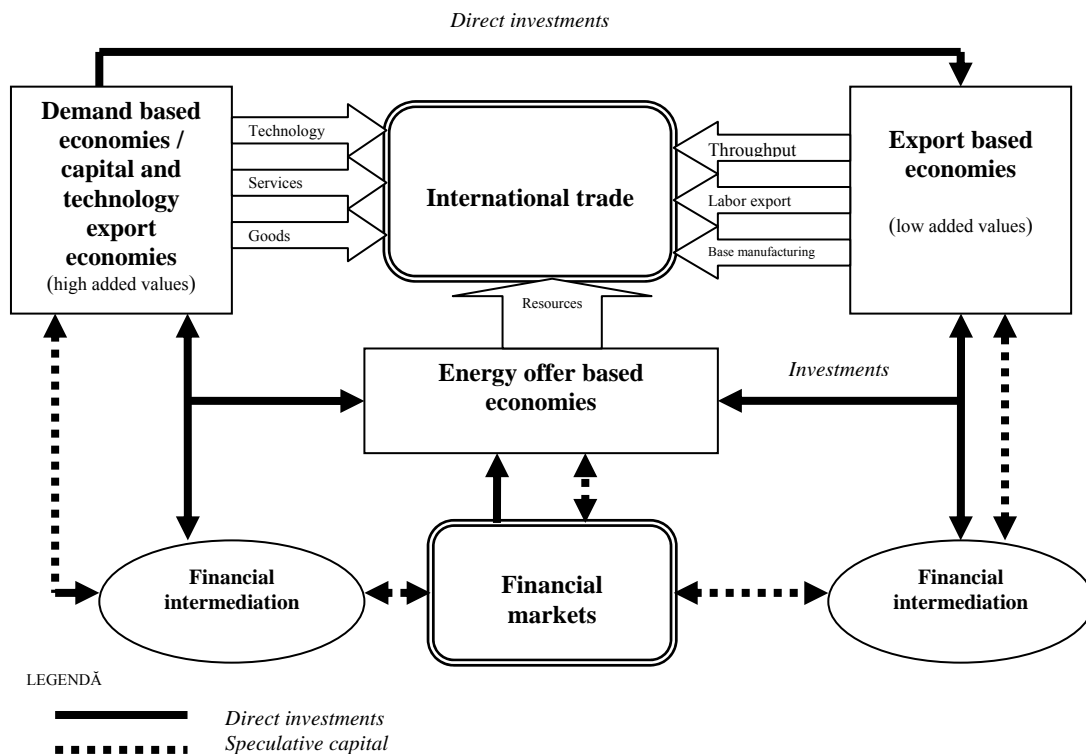
In the context of an international financial crisis changeovering into a deep economical recession, any intention for applying a demand increasing policy as a main doctrine for crises

overhaul seems to be wrong, considering the last year statistical picture. Taking under consideration the last evolutions regarding the main financial measures taken under

crises pressure on a global level, we are able to consider that the new typology proposed for national economies, would explain the mainly reasons for demand boosting policy failure, as follows: on the one hand the developed countries will take one's bearing toward crises bill regainment redrawing their financing and, on the other hand, the developing nations will slack their rates of growth because of general demand decrease, taking under consideration hard-landings perspective in the very next future.

Consumption boost based on credit access fosterage and financial incentive, should lead to an impact for the very short term perspective not for long or medium term. As an argument for this perspective we can mention all those monetary measures concerning repeated policy official rates diminishes (see FED interest's cuts or ECB consistent reductions) that couldn't stop effectively the demand falling. The international or national financing blockage is determined more or less rationally by the lack of trust in the market real values. So the crisis is not determined exclusive and definitively by the consumption „repulse” or by a lack of liquidities on the market. On the contrary the generally deflation indicates an excess of international liquidities related with the appetite for risk [1]. The generalized prices diminishing for investment goods, beyond the domino effect triggered in mortgage market, are able to relaunch the consumption on healthy basis and would reduce the panic related to the short term decision options or to the banking system overdue negotiations. This theory should be first correlated together with short term credit overdue “rolling” on a time grading long term formula and second together with the real manufacture sector restructuring. For a developed country the optimum economical relaunch method is not a variable of credit policy anymore but is dependable by the quality of the incomes/prices level on market that becomes unsecured under unemployment pressure. The capital injection in transnational companies who produces overstocks will stimulates the growth of those enterprises who already forget about production optimization models throughout short cycles (Kitchin cycles).

Under Taylor perspective, the real efficient economical organization is not in relation with overgrowth of transnational companies but it has a profound connection with the concept of rational work organization within enterprises, based on technological progress implementation [4]. As an example we can remember the Opel model that had been implemented the most completely robotized manufactory in car industry sector over the world (the technology sustains over 80% of the entire manufacturing cycle). This situation it should be offer the price advantage in terms of economical efficiency, being expected to see at least 10% reduction in selling prices. But on contrary, just to confirm our wonder, the prices had risen over 20% in the detail market, without any economical reason, in contradiction with scientific principles of work organization within an enterprise. To make matters more unclearly the Opel Company ask for supplemental capital injection, in the same rank as Ford, the last price increase being found practically nowhere. To continue the bad examples we can recall for Ford example that has been able to reduce the production costs, just from the head-office, with a percent between 10-15% almost in all budget expenses figures. In conclusion, the main and rational way to provide a financial support toward national relevant enterprises is to stipulate hard condition for this in terms of production scientific optimization, functionally and structurally as well. Over viewing all these observations, we can conclude affirming that the globalization process should be defined through the assembly of interactions manifested between different types of economies as it has been treated in previous scientific papers by the author, as follows: demand based economies - capital and technology export economies, export based economies, energy offer based economies [3]. The globalization dynamics is quantized statistically within two elements as follows: international trade evolution and integration level of financial markets. As we can observe analyzing the figure bellow, the described economies are functionally connected through merchandise fluxes and capital fluxes.



Functional relation between financial integration, economical globalization and international trade based on the new economies' typology

If the results of international trade are used constantly in saving direction on in direct investment decisions through financial intermediation sector, the equilibrium between these three types of economies should be not affected by the major imbalances determined by the interactions between real economy and financial speculative industry, the evolution trends following the economical classic theory. If the speculative capital flows become the main supplier for financial intermediation sector, in disadvantage of optimum economical effects, then the economical rations will turn one self round, winning the speculation. But the capacity of the states to react is different among new proposed typology of global economy and the crises will get different valences. The developed countries will fall in the first instance on short term being severely affected by market prices'

Conclusions

Taking under consideration all these remarks we can conclude that the developed countries short term imbalances will induce a long term crises on the developing countries level, lately but more severe as the starting points. The nominal economy disruptions, determined by capital

correction, owed to speculation losses. In next scene those affected developed countries will embrace the tendency to support the speculative positions' closing negative moving the corrections from the level of speculation to the level of the real consumption supported unfortunately most from credit base expenses. The developed countries will try to balance out the self negative effects on the shoulders of developing economies, through speculative monetary attacks or capital mark up, referred to money squeezing policies. The crisis will be contagiously transmitted to the developing countries even these nations are not implicated in any kind of speculations, affecting in chain, the performance of real economy, the aggregates of demand and the supply on the market terms. [3]

flows tendencies will induce real economy disequilibrium. On these lines, the recovery on international level should have the same direction, from the developed countries toward developing countries, but only if the recovery filled up the competitiveness spaces born together with the demand decompression on international level.

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INTERCOMPREHENSION IN LANGUAGE TEACHING. PRACTICABLE OR UTOPIAN?

Corina SANDIUC¹

¹ Junior assistant, "Mircea cel Batran" Naval Academy

Abstract: *Language is not only an instrument of communication, but also an important part of the world we live in. Therefore, speaking two or three languages and understanding many more opens the access door to a great amount of knowledge, helping people to exchange ideas more efficiently and to have greater autonomy on many different levels from professional to personal. In this context, intercomprehension emerges as the ability to understand a language which has not been studied before based on the discursive competences already developed. If this process is harmoniously developed, the study of different languages will not be limited to the acquisition of linguistic knowledge, but will allow for a new approach to language teaching and learning as a translinguistic process. The question that now arises is whether intercomprehension is something that can be taught in school as any other skill or just another theoretical concept with no real applicability.*

Key words: *intercomprehension, linguistic awareness, linguistic competence, comprehensive processes.*

Intercomprehension analysis is a new scientific branch within linguistics. It supposes training the skill to efficiently develop an understanding of new languages on the basis of existing language learning experience. The concept appeared in Europe during the last decade and has been subject to consistent development, although there is not a general common consensus about its definition. If we were to consider the etymology of the term intercomprehension (comprehend – prehend = seize, grasp, get) it would seem to be some kind of grasp of an unfamiliar language. The "seized" meaning leaves its imprint on the linguistic competence of the recipient and builds up structures that will help future comprehensive processes. In this paper, we will see intercomprehension as: "a form of communication in which each person uses his or her own language and understands that of the other." [1] (Peter Doye, *Intercomprehension. Guide for the Development of Language Education Policies in Europe: From Linguistic Diversity to Plurilingual Education*, Council of Europe, 2005, p.7)

Intercomprehension is a quality of any intercultural communication, it refers to the way people understand each other across various group boundaries – linguistic, social, ethnic etc.

In exploring the new field of the European Union, greatly marked by diversity, we shall be dealing with "understanding". The Council of Europe has been trying to promote awareness of a European identity based on shared values and cutting across different cultures. It is widely believed that: "Policies for language education should therefore promote the learning of several languages for all individuals in the course of their lives, so that Europeans actually become plurilingual and

intercultural citizens, able to interact with other Europeans in all aspects of their lives." [2] (Stephan Breidbach, *Plurilingualism, Democratic Citizenship in Europe and the Role of English*, Council of Europe, 2003.

<http://www.coe.int/t/DG4/linguistic/Source/BreidbachEN.pdf>

Competence in language is a prerequisite and a characteristic of democratic citizenship in Europe.

The European Commission also aims at:

1. The differentiated consideration of competences and hence support for the development of receptive multilingualism.

2. Enabling the focused acquisition of partial competences with possibilities for modular expansion (e.g. modular approach in technical language for receptive reading competence)

3. The cognitive usage of group relations between languages (such as Romance intercomprehension research) [3] (European Commission, *White Paper on Teaching and Learning – Towards the Cognitive Society*, Luxembourg [office for official Publications of the European Communities], 1996). Given the professional migration of the past years, and the thin border line between the European countries, it is only natural that students should develop broad receptive competences in order to quickly develop productive competences in a new linguistic environment. Academically, the individuals should be able to understand and produce discourse in more than one language. Professionally, they are required to communicate in a specific domain observing its socio-cultural conventions.

But how is individual plurilingualism and group multilingualism of European citizens to be achieved?

One step forward was taken by a series of programs promoting intercomprehension and language awareness in Europe. The programs implemented apply to three mutually supporting levels: language policy, language teaching and linguistics. We will focus here on the language teaching aspect. One of the most well known such program is Euro Com. Euro Com stands for Euro Comprehension and has designed a teaching approach meant to achieve receptive competence in all Romance languages. The aim of this project is to realistically enable Europeans to achieve multilingualism. According to its researchers, knowledge of the mother tongue and just another foreign language will give students a great level of advance knowledge, allowing them to be able to easily and rapidly understand the news of technical texts in all other related languages, although not studied beforehand.

Euro Com is an economical way to support the acquisition of language learning competence because it teaches transfer-based deduction strategies to enable receptive competence using the “seven sieves”, and extracts familiar matter from languages which are related. Readers learn the forms of correspondence in different target languages and are rapidly able to interrelate the graphemic peculiarities of the related idioms. This project tries to advance European multilingualism by focusing on reading competence as a modular point of access to other languages “creating an integrated network for intercomprehension by means of adaptations and communicating the findings interactively to a broad audience via CD-Rom and on the Internet.

Adaptations of Euro Com for 10 different source languages are currently being developed in cooperation with the universities of Barcelona, Bucharest, Innsbruck, Lisbon and Szeged.

IGLO (Intercomprehension in Germanic Languages Online) is another such project, but this one encompasses only Germanic languages and is aimed at people who already know one. Its aim is to promote cross-linguistic comprehension among the Germanic languages. The end product is a software using the multidimensional nature of computerized information to allow the complex network of relations among seven Germanic languages selected (English, German, Dutch, Norwegian, Swedish, Danish, and Icelandic) to be displayed in a systematic way. The database contains information on all these languages and how they relate in various aspects of their grammar, vocabulary, and phonology.

Also focusing on developing the students’ plurilingual and pluricultural competence is the **EU and I** project (European Awareness and Intercomprehension). Just as the other projects, it concentrates on the learners’ receptive skills, when the subjects are exposed to foreign languages they have not learnt. The innovative fact about this project is that it confers relevance to the textual and socio-cultural dimension of intercomprehension as it arises from both linguistic transfers and textual and socio cultural experience. EU&I tries to raise language awareness in Europe by developing *learning how to learn* abilities in the learners and promotes intercultural awareness by stressing similarities and differences that support interpretation processes

Other projects include:

- **Intercommunicabilité romane** which aims to form receptive and productive competences in Italian, Portuguese and Spanish for speakers of French.

- **Eurom4** aims at enabling the native speaker of a Romance language (Spanish, French, Italian and Portuguese) to reading and listening comprehension in the other three languages.

- **Galatea** (1996-1999) whose goal was the elaboration of didactic documents to train speakers of a Romance language to the oral and written comprehension of another Romance language.

All these projects have opened the way to new teaching methods. Intercomprehension is an influential factor

in the organization and sociolinguistic foundations of language teaching. It implies the change in form of the curricula and syllabi for language teaching, as well as of the teaching methods. Moreover, as the challenge of intercomprehension aims at the realization of a plurilingual education, it gave way to a new and broader approach to language teaching and language learning, which highlights linguistic and cultural diversity.

Traditional language teaching approaches each language as a whole, isolated from other foreign languages, and focuses on comprehension as well as on production. This leads to a difficult and time-consuming process. To simplify it researchers have thought of concentrating on comprehension and not production. This task is greatly simplified by the fact that the languages taught are closely related to the mother tongue of the students. Intercomprehension is highly beneficial to our students’ formation because it guarantees autonomy in the professional and personal life, making it possible to get informed more efficiently. Speaking two or three languages and understanding four or five gives the students the possibility to access a huge range of knowledge and to exchange ideas more efficiently.

Intercomprehensive language education presupposes that intercomprehension can be supported by teaching. However, will the foreign language teachers be able to develop a different self-image as language teachers on a plurilingual conception of language teaching? To this effect, they should understand their role, create a new identity for themselves as language educators, and attend innovative language teacher education programs because it is the teachers who should use their skills to create the proper conditions of learning in order to help students acquire intercomprehensive competence.

Therefore, it seems that the most important intercomprehensive competence is awareness (cultural and linguistic) and its development seems to be the major task for both the teacher and the student. In the classroom, it is up to the teacher to motivate students so that they make use of their abilities in order to understand and gradually produce language. The teacher’s own language culture awareness is vital if he/she wants to explain the mechanisms of intercomprehension. The students’ position is one of developing such awareness, with the teacher’s constructive feedback as a strong motivating factor.

Thus, motivation plays a vital part. The teacher should make students aware of their already acquired knowledge and encourage them to use it in order to decipher new ones. As Noam Chomsky puts it: “the person who has acquired knowledge of a language has internalized a system of rules that relate sound and meaning in a particular way. The linguist constructing the grammar of a language is in effect proposing a hypothesis concerning this internalized system.” [4] (Maria F. Capucho, *The Role of Intercomprehension in the Construction of European Citizenship*). The learners’ prior knowledge and skills represent a decisive factor in the process of learning foreign languages. In this sense, teachers should motivate students to recognize and activate their explicit and implicit linguistic and cultural knowledge skills. In addition, intercomprehension gives greater autonomy to the learner. Therefore, teachers should be guides assisting students but not interfering. They should base their assistance on a clear observation of the students’ needs and enable them to use this knowledge by developing the appropriate strategies and skills. We are dealing with a self-organized, self-directed process where the students take the first steps and the teacher – only after close observation of their needs offers support.

Nevertheless, the question still remains: Is intercomprehension really practicable or is it an utopia? Will European citizens be able to use their mother tongue anywhere in Europe and be understood? Is this the solution to save those “endangered” languages?

The skeptics agree upon the validity of the concept, but consider it impossible to put into practice. There is little doubt though that intercomprehension has existed for a long time and is already a reality in many European countries and in many people’s everyday lives.

Research has shown that nowadays more than 50% of the European population is already bilingual. Yet, only 26% say they can speak two foreign languages. English is indeed the foreign language most frequently used by Europeans (41%), followed by French (19%), German (10%), Spanish (7%) and Italian (3%).^[5] (Maria F. Capucho, *The Role of Intercomprehension in the Construction of European Citizenship*). As we can see, the results seem to demonstrate that less than half of the European population can actually use English. Nevertheless, 75% of the interviewed Europeans consider it useful to know English, while only 39% and 22% respectively say the same about French and German. Moreover, multilingualism seems to be on a good way as, according to statistics, 93% of parents of children under 20 consider it important that their children learn other European languages.

As the numbers show, the Commission's objective concerning a European Union in which all citizens can speak their mother tongue plus two other European languages is far

from being attained. However, one cannot ignore the positive results that have been brought about by the efforts put during the last years into language education in Europe. The European Commission has been actively promoting all the languages of the Union, especially those that are less widely used and less taught. Many agree that “what has happened over the past two years is of tremendous importance for education and training in general and for language learning in particular. Never before have the Member States placed such great emphasis on education and training, never before have they expressed such firm commitment to the learning of languages.” ^[6] (W. Mackiewicz, *Lifelong Foreign Language Learning*), plenary given at the seminario UE “Las necesidades del aprendizaje de las lenguas extranjeras en los sistemas” cited by Maria F. Capucho. Indeed, intercomprehension, a concept of particular importance in the multicultural and multilingual European world, seems to be the way towards language learning and cultural diversity; a goal not yet attained, but not impossible to reach either.

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TEACHING ENGLISH - NOT AN EASY TASK

Gabriela ȘERBĂNOIU¹

¹ PhD Senior Lecturer, Police Academy Bucharest

Abstract: *This paper focuses on aspects of teaching English, including the covering of all skills involved in the process, going through choosing the right coursebooks with the right criteria of assessment, teacher's roles etc. I have started from the premise that lesson planning is the art of combining a number of different elements into a coherent whole so that a lesson has an identity which students can recognise, work within, and react to - whatever metaphor teachers may use to visualise and create that identity. We, the teachers, need to consider a number of crucial factors such as the language level of our students, their educational and cultural background, their likely levels of motivation, and their different learning styles.*

Key words: *selection and grading, language study activities, language skill activities, topics.*

Covering all the four skills in the process of teaching and learning English is the ideal objective that might be achieved in the same seminar when teaching English at academic level. The specialists say that there is a fourth skill involved in this process: viewing which is more complex, because it involves not only listening comprehension, but much more.

Throughout my professional life, I have learned that in teaching, the way we give feedback on writing will depend on the kind of writing task the students have undertaken, and the effect we wish to create. When students do workbook exercises based on controlled testing activities, we will mark their efforts right or wrong, possibly outlining the correct answer for them to study. However, when we give feedback on more creative or communicative writing, we will approach the task with circumspection and clearly demonstrate our interest in the content of the students' work.

Intensive listening/viewing: the roles of the teacher

As with all activities, for listening we need to be active in creating student engagement through the way we set up tasks. We need to build up students' confidence by helping them listen/watch better rather than by testing their listening abilities. In particular we need to focus on the following roles:

- **Organizer:** we need to tell students exactly what their listening purpose is, and give them clear instructions about how to achieve it. One of our chief responsibilities will be to build their confidence through offering tasks that are achievable and worksheets/activities that are comprehensible.

Generally speaking, there are a lot of written feedback techniques and when handing back students' written work, we can use a number of devices to help them write more successfully in the future:

- **Responding:** one way of considering feedback is to think of it as 'responding' to students' work rather than assessing or evaluating what they have done. When we respond, we say how a text appears to us and how successful we think it has been - and, sometimes, how it could be improved. Such responses are vital at various stages of the writing process cycle. Thus students may show us a first draft of their work; our response will be to say how it is progressing and how we think they might improve it in subsequent drafts.

- **Feedback organizer:** when our students have completed the task, we should lead a feedback session to check that they have completed the task successfully. We may start by having them compare their answers in pairs and then ask for answers from the class in general or from pairs in particular. Students often appreciate giving paired answers since, by sharing their knowledge, they are also sharing their responsibility for the answers. Because listening can be a tense experience, encouraging this kind of cooperation is highly desirable.

It is important to be supportive when organizing feedback after watching a video tape if we are to counter any negative expectations students might have.

• **Prompter:** when students have listened to a tape or disk for comprehension purposes we can have them listen to it again for them to notice a variety of language and spoken features. Sometimes we can offer them script dictations (where some words in a transcript are blanked out) to provoke their awareness of certain language items.

Listening lesson sequences might have a paramount importance in the process of teaching English.

Listening can occur at a number of points in a teaching sequence. Sometimes it forms the jumping-off point for the activities which follow. Sometimes it may be the first stage of a 'listening and acting out' sequence where students role-play the situation they have heard on the tape. Sometimes live listening may be a prelude to a piece of writing which is the main focus of a lesson. Other lessons, however, have listening training as their central focus.

Choosing coursebooks

The 'assessment' of a coursebook is an out-of-class judgement as to how well a new book will perform in class. Coursebook 'evaluation', on the other hand, is a judgement on how well a book has performed in fact.

One approach to the assessment of coursebooks is to use a checklist - or checklists prepared by others which analyze various components of the material whether linguistic, topic, or activity based. However, a problem with such assessments is that however good they are, they may still fail to predict what actually happens when the material is used. And when we use a checklist prepared by other people we are accepting their view of what is appropriate in our particular situation. Nevertheless, we need some basis for choosing which books to use or pilot, whether we use checklists prepared by others or whether we make them

Criteria for assessment

The following three-stage procedure allows teachers to assess books on the basis of their own beliefs and their assessment of their students' needs and circumstances:

• **Selecting areas for assessment:** we first need to list the features we wish to look at in the coursebook(s) under consideration, as in the following example:

- Price (of coursebook components)
- Availability
- Layout and design
- Instructions
- Methodology
- Syllabus type, selection and grading
- Language study activities
- Language skill activities
- Topics
- Cultural acceptability
- Usability
- Teacher's guide

Evaluation measures

Evaluation of materials which we have been using is somewhat different from assessment. Once again, however, it can have three stages:

Teacher record: in order to evaluate materials we need to keep a record of how successful different lessons and activities have been. One way of doing this is to keep a diary of what happens in each lesson. A more formal version of the same thing might involve detailed comments on each activity.

There are many other ways of keeping records: we could give each activity a score from 0-5; we could design a rating scale to measure student satisfaction with a lesson or parts of a lesson. We could write reports at the end of every week under headings such as *recycling*, *reading progress*, *vocabulary work*, or *teacher's guide*. Some teachers write comments in the coursebook itself. But in each case we will end up with something which is more useful than a mere feeling.

Teacher discussion: when new books are being used it helps if the teachers who are using the same book get together and compare their experiences. This may involve going through lessons (and exercises) one by one, or it may

However much we have planned a lesson, we need to be flexible in what we do. Nowhere is this more acute than in the provision of live listening, where we may, on the spur of the moment, feel the need to tell a story, or act out some role. Sometimes this will be for content reasons - because a topic comes up - and sometimes it may be a way of refocusing our students' attention.

Most listening sequences involve a mixture of language skills - though one, in particular, is often the main focus of the sequence. Frequently students listen for gist on first hearing before moving on to different task skills; at other times they may listen for specific information straight away.

In general we should aim to use listening material for as many purposes as possible - both for practising a variety of skills and as source material for other activities - before students finally become tired with it.

ourselves. We can then see whether our out-of-class judgements are borne out in reality.

A potential difficulty for successful post-use 'evaluation' of a coursebook, on the other hand, is that 'teachers see no need for systematic and principled post-program evaluation'. In part this is because teachers tend to feel that they 'know' whether a coursebook worked or not, and they are reluctant to give time to a more formal evaluation once a course has finished. Yet we need to evaluate material in a reasonably structured way if we are to properly see if our pre-use assessment was accurate, and whether to continue to use the coursebook.

Whether assessing or evaluating coursebooks, we should do our best to include student opinion and comment. Their view of layout, design, content and feel should inform our pre-use assessment and our post-course evaluation.

The list can be reduced or expanded, of course. We might separate language study activities into vocabulary, grammar, and pronunciation, for example; or, we might want to concentrate solely on topics and cultural acceptability. We can choose what we want to focus on in the light of our own teaching situation.

Stating beliefs: we are now in a position to make 'belief statements' about any or all of the areas we have decided to concentrate on. This can be done by a group of teachers writing their individual beliefs and then combining them into an agreed set - such as the following statements about layout:

The page should look clean and uncluttered. The lesson sequence should be easy to follow. The illustrations should be attractive and appropriate. The instructions should be easy to read.

Using statements for assessment: we are now ready to use our statements of belief as assessment items. This means that for each of our areas we list our statements, and can then use a simple tick and cross system to compare different books.

centre round a discussion of the audio material and its related exercises. Someone in the group should circulate a record of what is said, so that teachers can review the discussions before coming to a conclusion.

Student response: as with teachers' reactions, student responses can be collected in a number of ways. One way is to ask them if they enjoyed the material they have just been using. This kind of oral feedback can be unreliable, however, since some students can dominate the conversation and influence their colleagues.

We may get better feedback by asking for a written response to the materials with questions

Because students' perception of their own progress will influence their responses to the material they are using, it is important to encourage them to assess their own performance, and to discuss the conclusions they come to. Alternatively, we could have them (in groups) talk about the lessons they have been studying and provide a short written summary of their group's joint conclusions.

The information gained through the evaluations has to be set against other measures such as achievement test scores and durability. With all this information we can

compare results with colleagues so that we reach confident decisions about whether the book has lived up to the original assessment we made of it.

Using coursebooks

For years methodologists have been arguing about the usefulness of coursebooks, questioning their role, defending their use, worrying that they act as methodological straitjackets, or promoting their value as agents of methodological change.

Coursebook or no coursebook?

The benefits and restrictions of coursebook use can be easily summarized:

- **Benefits:** good coursebooks are carefully prepared to offer a coherent syllabus, satisfactory language control, motivating texts, tapes and other accessories such as videotapes, CD-ROMs, extra resource material, and useful web links. They are often attractively presented. They provide teachers under pressure with the reassurance that, even when they are forced to plan at the last moment, they will be using material which they can have confidence in. They come with detailed teacher's guides which not only provide procedures for the lesson in the student's book, but also offer suggestions and alternatives, extra activities, and resources. The adoption of a new coursebook provides a powerful stimulus for methodological development.

Students like coursebooks too since they foster the perception of progress as units and then books are completed. Coursebooks also provide material which students can look back at for revision, and at their best their visual and topic appeal can have a powerfully engaging effect.

- **Restrictions:** coursebooks, used inappropriately, impose learning styles and content on classes and teachers alike appearing to be facts accomplished over which they can have little control. Many of them rely on Presentation, Practice, and Production as their main methodological procedure despite recent enthusiasm for other teaching sequences. Units and lessons often follow an unrelenting

Options for coursebook use

The first decision we have to make is whether to use a particular coursebook lesson or not. If the answer is 'no', there are two possible courses of action. The first is just to omit the lesson altogether. In this case we suppose that the students will not miss it because it does not teach anything fundamentally necessary and it is not especially interesting. When, however, we think the language or topic area in question is important, we will have to replace the coursebook lesson with our own preferred alternative.

Conclusions

I conclude by saying that teaching English is not an easy task at all; it is demanding, challenging, but we can say that it may

format so that students and teachers eventually become demotivated by the sameness of it all. And in their choice of topics coursebooks can sometimes be bland or culturally inappropriate.

One solution to the perceived disadvantages of coursebooks is to do without them altogether, to use a 'do-it-yourself' approach. Such an approach is extremely attractive. It can offer students a dynamic and varied program. If they can see its relevance to their own needs, it will greatly enhance their motivation and their trust in what they are being asked to do.

It allows teachers to respond on a lesson-by-lesson basis to what is happening in the class. Finally, for the teacher, it means an exciting and creative involvement with texts and tasks. In order for the approach to be successful teachers need access to (and knowledge of) a wide range of materials, from coursebooks and videos to magazines, novels, encyclopedias, publicity brochures and the Internet. They will have to make (and make use of) a variety of homegrown materials. They will also need the confidence to know when and what to choose, becoming, in effect, syllabus designers in their own right. This not only makes preparing lessons a very time-consuming business, but also runs the risk that students will end up with an incoherent collection of bits and pieces of material. However, where there is time for the proper planning and organization of teaching, students may well get exceptional programs of study which are responsive to their needs, and varied in a way that does not abandon coherence.

Although there is nothing wrong with omitting or replacing coursebook material, it becomes irksome for many students if it happens too often, especially where they have had to buy the book themselves. It may also deny them the chance to revise (a major advantage of coursebooks), and their course may lose overall coherence.

Using coursebooks appropriately is an art which becomes clearer with experience.

equally be fun and pleasure not work sometimes, it is responsibility as teachers are not providers of knowledge as they used to be in the past, but providers of skills and the students will always be critical observers.

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MAKING USE OF PROPER NAMES IN FOREIGN LANGUAGES CLASSES

Anca SIRBU¹

¹ Asist. univ. dr. Anca Sirbu, Academia Navala “Mircea cel Batran” Constanta

Abstract: *This article provides an overview of the role of proper names in German language classes. Learners of German as a foreign language are normally confronted with German proper names in their textbooks. Students learning German are faced with many difficulties with regard to proper names. The recognition of proper names constitutes one of the major problems in terms of teaching German as a foreign language. For German, it is difficult to decide whether a capitalized word is a proper name because proper names and generic terms (normal nouns) are capitalized both at the beginning and within a sentence. These difficulties can be minimized in different ways: e.g. by collecting differently spelt family names from various sources such as a phone directory or a newspaper, by comparing idiomatic phrases or communication rules with those in the first language, or by listing names that students may be familiar with, like the name of a town or a famous brand.*

Key words: *proper names, German as a foreign language*

This article provides an overview of the role of proper names in German language classes. As they cover grammar as well as cultural learning, consideration can be given to a holistic approach of proper names in teaching German as a foreign language. Brand names and product names are also considered, alongside terms of address, since the latter often accompany proper names or can replace them in communication.

Students gradually acquire another system of communication. Thus, they come to realize that the new language is not only a set of codes by which they can express their own ideas, but an important part of a culture different from their own. They will actually find that some distinctions they make in their mother tongue cannot be made in the new language and that other ways of thinking and experiencing are essential if they want to communicate in that language. At advanced levels of foreign language instruction, students can use the new system of communication as a means of broadening their knowledge and appreciation of literature, humanities, etc.

The recognition of proper names constitutes one of the major problems in terms of teaching German as a foreign language. For German, it is difficult to decide whether a capitalized word is a proper name because proper names and generic terms (normal nouns) are capitalized both at the beginning and within a sentence. It is difficult to decide which of the capitalized words belong to the proper name and which not, e.g. if it is a first name (as in “Helmut Kohl”), an apposition (as in “Bundeskanzler Kohl”), or if it is a complex institutional name composed of several generic terms and a proper name (as in “Vereinigte Staaten von Amerika”). Proper names could be evaluated on the basis of their syntactic and textual context together with a morphological analysis. As a starting point of the analysis we can consider a number of definite minimal contexts like titles (e.g. “Prof.”, “Dr.”) and forms of address (e.g. “Herr”, “Frau”), which may increase with the processing of texts in which proper names are identified, and thus supply new contexts which can be used to find new proper names.

Learners of German as a foreign language are normally confronted with German proper names in their textbooks and learn implicitly the rules of using proper names in communication. Students learning German as a foreign language are faced with many difficulties with regard to proper names. These difficulties can be minimized in different ways: e.g. by collecting differently spelt family names from a phone book, by comparing idiomatic phrases or communication rules with those in the first language, or by listing names that they may be familiar with, like the name of a town or a restaurant.

Although names and other words are all part of the same language and although there is a two-way exchange between names and other words (all words can become names and names can become words), names have been seen as having a special status due to their peculiarities. For instance, since names refer to individuals, they are always singular. However, plural forms of names can also be found (e.g. “the Simsons”). Nevertheless, where there is a peculiarity, there is always also an exception: while we do not generally translate proper names, we do translate “NATO”, “Rotes Kreuz”, “Ludwig XIV” etc.

The nature of proper names is very complex, though some special rules are over-generalised, in the sense that they will actually not always apply, e.g. to plural forms or translations. Nevertheless, such rules are also applicable to languages other than German, although with some different specifications, for example with regard to the articles (e.g. “die Schweiz”, but “Switzerland”).

There is plenitude of relations between different academic fields and proper names, which can be seen in all fields of linguistics and related disciplines. All of these

aspects can play a role in language classes, but proper names do not play a central part in German language teaching. The aim is to make students aware of similarities and differences between languages and their sociocultural usage, in order to allow them to understand better the mechanisms of language(s), to increase their curiosity about and interest in the German language and to make them more competent in dealing with languages (and their speakers). This will also help learners understand connotations of names which are often part of the cultural traditions like “Dr. Oetker”, a very well known name in Germany because of Dr. Oetker puddings. They will also become aware of rules for “du/Sie” in congruence with first and family names as well as be able to recognise and make appropriate use of proper names in communication: “Frau Ministerin Schmidt”.

Although the syllabus for German as a foreign language does not typically consider proper names, a teacher who is keen to deal in greater depth with proper names and to make students aware of their linguistic peculiarities and communicative functions, will find places in the syllabus where they will fit very well. Thus, proper names can frequently provide a means highlighting various aspects of language at the same time. For example, teachers can introduce the suffixes “-er” and “-in” in grammar teaching (morphology/word formation) in order to help learners discriminate between masculine and feminine names, but they can also provide students with the communicative functions of these suffixes as well (e.g. “Herr Lehrer”, “Frau Professorin”). Consequently, forms of address can also be taught in this manner, since “Herr Lehrer” or “Frau Professorin” are sometimes accompanied by the names of the persons addressed. Also, where the title is used with a name, whether it is a title such as “Herr”, “Frau” or an academic or aristocratic title, a noun used for naming relatives (e.g. “Onkel Thomas”, “Oma Anna”), students can be taught what kind of name (first or family name) has to be used and the choice of name to signal familiarity or affection (e.g. “Katharina”, “Johanna”). These are all only a few instances of making use of proper names in teaching German as a foreign language.

However, special consideration should be given to particular grammar issues when teaching classes of students who are fluent in English. Since it is common knowledge that English and German are related, students often develop a tendency of mistaking English language/grammar rules and words for German ones. One widespread example is the incorrect use of an apostrophe in German possessive forms, as in “Michael’s Auto”. This common error can be also seen for plurals ending in “-s”. Another example is a growing tendency to drop the hyphen (English-style) in German compound words: Friedrich Schiller Straße vs. Friedrich-Schiller-Straße.

Proper names are part of the lexicon of a language, or more precisely, of the nouns of a language. The term “proper names” is used presently in a fairly broad sense, as we have tackled both personal and topographic names, including nicknames and street names.

As we showed before, multi-word proper names consisting of normal nouns or mixed of normal nouns, adjectives, articles, prepositions and proper names constitute a major problem. Apart from the fact that adjectives and prepositions belonging to a proper name are capitalized (e.g. “Gasthaus Zur Guten Quelle”), some of these proper names behave like normal nouns, i.e., they are inflectional and take an article (e.g. “die Bundesrepublik Deutschland”), but some do not (e.g. “Ich wohne in der Straße “Am Hafen”). For one it is difficult to determine which constituents belong to the proper name, and which do not when the construction can be modified and reduced as well (e.g. “Vereinigte Staaten von Amerika”, “die Staaten”, “die Bundesrepublik”, “Deutschland”).

because of their constant everyday use, provide a valuable basis for the development of language teaching. Furthermore, this could facilitate a broadening of the curriculum and challenge the recent dominance of grammar in German

Conclusions

This paper has provided a brief overview of the usefulness of proper names in language teaching in the context of German curricula and syllabi. Proper names,

language education. A further reason for using proper names in foreign languages classes, thus making students aware of language-use is that many people (even school pupils) have already been involved in name-giving: choosing a name for a new child in the family, for a pet or a doll, or coming up with a

nickname or pet-name for a friend or relative requires thinking about names. This awareness can be further developed in school and may help raising awareness in other areas of language.

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TEACHING ENGLISH THROUGH VOCABULARY

Dana Carmen ZECHIA¹

¹ Lect. univ. dr. Dana Carmen Zechia, “Mircea cel Batran” Naval Academy, Constanta

Abstract: *Vocabulary is most frequently taught in a spoken or written context, and we have already seen that there are good arguments for this approach. We are going to look at contexts at various levels, and discuss ways they can be exploited for vocabulary teaching purposes. Basically learning a foreign language is a matter of learning the vocabulary of a language. Not being able to find the words you need to express yourself is the most frustrating experience in speaking another language. Vocabulary is not the whole story; the system of language is also important. It is possible to have a good knowledge of how the system of a language works and yet not be able to communicate in it. Whereas, if we have the vocabulary we need, it is usually possible to communicate.*

Key words: *vocabulary, system, teaching, language, knowledge.*

It has often been remarked how strange it is that comparatively little has been written on the teaching and learning of foreign language vocabulary, because there is a sense in which learning a foreign language is basically a matter of learning the vocabulary of that language. Not being able to find the words you need to express yourself is the most frustrating experience in speaking another language. Of course vocabulary is not the whole story: the system of language is also important. Nevertheless, it is possible to have a good knowledge of how the system of a language works and yet not be able to communicate in it; whereas if you have the vocabulary you need it is usually possible to communicate.

There are some symptoms of bad vocabulary learning or teaching. One is the inability to retrieve vocabulary that has been taught. In this situation, either communication breaks down altogether or else the student has to use some ‘repair strategy’, such as expressing his meaning in a different way.

Another symptom is the use of the vocabulary inappropriate to the given situation. The pupil knows a word which has the particular meaning required, but somehow doesn’t fit in the language situation in which he is operating. To take an example: normally, *right* (hand side) and *left* (hand side) are perfectly acceptable ways of indicating direction, but on board a ship, there are situations where these terms would sound strange.

The vocabulary must be also used at the appropriate level of formality. The words we choose have to relate to the formality of the situation in which we are speaking, and the relationship between the speakers. In learning a foreign language there is a tendency to use the more formal language in textbooks in normal conversational situations, with results that strange to the native speaker. The reverse can also happen where a learner picks up a slang or colloquial expression and uses it inappropriately.

Possessing the wrong kind of vocabulary for one’s needs is another problem. If the learner is going to be involved only in face-to-face contact with native speakers, then what he needs is the conversational language for those situations: it will not be much help to him to have a large reading vocabulary of words he can hardly pronounce. On the other hand, if the learner is going to be spending the rest of his life in his own country and needs English only for reading books in his area of specialism, then an extensive reading vocabulary may be precisely what is required. Hours spent on conversational practice may be time wasted.

The area of study is also important. Someone who is studying medicine in English needs to know English

medical words and expressions. If at some stage he is going to be talking to native-speaker patients, then some knowledge of colloquial terms that occur in doctor-patient discussions may also be necessary.

Another bad symptom is the incorrect use of a dictionary. Some students are not aware of the most efficient way to use a dictionary. Others go to the other extreme and are over-conscious of the importance of checking individual words. Whenever they come across a new word in a passage, they will immediately stop and not proceed until they have checked it up in a dictionary. This can kill all interest and even interfere with comprehension because the reader is so concerned with the individual words that he is less aware of the context which gives them meaning. It also results in very slow and very and inefficient reading. Some learners, even in conversation, will stop to check up their bilingual dictionary for the words they need, instead of perhaps finding another way to express it or enlisting the help of the native speaker they may be talking to.

The linguistic study of vocabulary (‘lexis’) can lead us on to the discussion of all sorts of fascinating topics, some of which have only marginal relevance to language teaching. Nevertheless, it seems sensible to look at a few basic elements in the study of lexis which have obvious teaching implications, if only in making useful distinctions, and establishing some useful relationships.

What is the difference between being *slim* and *thin*, and even *skinny*? What is the difference between a *fat* baby and a *plump* one? Denotatively, that is, in terms of who they are referring to, there may be no difference at all: the slim person and the skinny person may all be the same weight. The choice of one phrase rather than the other will probably indicate how the speaker *feels* about the person in question.

Certain words are chosen because they convey some kind of feeling or judgment. If one approves of the way in which someone sticks to his opinion one may applaud the fact that he is *resolute* or *determined*; to someone for whom this kind of behavior is awkward or a nuisance, the same person may be *stubborn*, *obstinate* or even *pig-headed*. Therefore we say that this kind of words tend to have connotations; rather similar to the connotations of a word are its associations, but whereas connotations relate to the system of a language, associations relate more to the individual or the culture.

Clearly there is not much to be done about the private associations which words have for individuals, but the teacher may well feel that associations which relate the culture of the target language, and certainly the connotations

of a particular word are part of the ‘meaning’ which has to be learnt.

The meanings of certain words are so closely related that they are often confused by the learner. This is especially true of words with *reciprocal meanings* such as words like *borrow/lend*, *bring/take*, or *imply/infer*. Another teaching problem arises with words which are in the same rough area of meaning or *semantic field*. An important distinction which is often made is between *productive* and *receptive* vocabulary. Everyone who learns a foreign language is usually able to recognize many more words than he can produce. It is much more difficult to produce a word correctly: one has to pronounce or spell it in the right way, use it in the correct grammatical form, use it appropriately with the correct words coming before or after it. It may therefore be important for a teacher to decide which words he wishes a student to *produce* correctly, and which words he wishes him merely to *recognize*.

These aspects of a word are related in English, because it is the comparative unpredictability of the English sound-symbol relationship which causes so many problems. Learners are puzzled by words which have very different forms but are pronounced identically (*genes/jeans*, *break/brake*) and also by words which are very similar in form but pronounced differently (*bough, tough, though*).

Spelling mistakes less frequently cause lack of understanding, and are more often simply a give-away of the writer’s status as a learner. Again it is the lack of fit between the sound and the spelling system which causes problems: -*or/-ar/-er* and -*able/ible* groups of suffixes, for example, are pronounced in exactly the same way. It may comfort learners to know that native speakers sometimes tend to be as confused as they are.

As far as intelligibility is concerned, getting the correct stress is often extremely important, since, in English, the stress pattern of a word determines its pronunciation of the individual vowel sounds: only in the stressed syllable does the vowel tend to get its full value, the other unstressed vowels tending to be neutralized. Thus words like *re’ceptive* and *’recognize* are stressed on the wrong syllables, they can become almost impossible for the native to catch in a flow of speech, especially when other words in the learner’s speech are also being wrongly stressed. Word stress patterns are often used systematically in various ways.

It is, also, possible to ‘know’ a word, without necessarily knowing how to use it in all its various forms. So, for example, a learner will know how to use the adjective *big* for some time before he learns its comparative forms *bigger* and *biggest*. With nouns, however, we would expect the singular and plural forms to be available almost at the same time. Until now, we have been assuming that it is important to ‘teach the meaning’ of a word, without specifying very closely what ‘teach the meaning’ implies. As the student’s command of the language improves, he will discover that even the words with a ‘straightforward’ meaning can have a wide range

of *denotations* according to the context. Word meanings are best learned through conceptual development. This approach stresses in-depth understanding as opposed to surface understanding. Existing concepts can be used as a basis for acquiring new concepts. For example, a student who knows what a horse is can relate the new concept of *unicorn* to *horse* in order to understand the new concept.

Word meanings should be learned in context. The contextual setting gives student clues to word meanings. The teacher should provide examples in which the new word is used correctly and students should have opportunities to apply the word’s meaning. Vocabulary instruction should be based on learner-generated word meanings. Learner involvement increases understanding and memory; thus, when students use their experience and background knowledge to define words, they learn better. The words serve as labels for concepts and students associate words to a larger vocabulary and experiences.

Vocabulary should focus on usable words. The use of vocabulary related to a theme or instruction in “word webs” is helpful. Students should be taught how to figure out related words. Students should, also, be taught the use of context clues and structural analysis skills (prefixes, suffixes, root words). Another important idea is that students should learn to use the dictionary, thesaurus and glossary to develop understanding of word meanings when they cannot figure out the meanings from experience, context or structural analysis.

Learning vocabulary is a rather more complex process than it might at first sight appear. To ‘know’ a word in a target language as well as the native speaker knows it may mean the ability to recognize it in its spoken or written form, relate it to an appropriate object or concept, use it in the appropriate grammatical form, pronounce it in a recognizable way, spell it correctly, use it with the words it correctly goes with, for example, in the correct collocation, use it in the appropriate level of formality and be aware of its connotation and association.

The teacher has the job of so managing the learning that the learner can do some or all of these things with the target vocabulary that is to be learnt. Unless the teacher is clear on this point, it will be difficult to assess how successful or otherwise the vocabulary learning has been. Control of the amount of vocabulary inevitably means choice as to the specific items to be taught. In most cases the choice will be made for the teacher by the course book or syllabus he is using.

In a way, what we have been saying about how vocabulary is acquired should be encouraging, since it shows us that learners can be their own best teachers, if they are exposed to the target language in an appropriate way. It is unfortunate that most learners of a foreign language are not exposed to it in situations outside the classroom as native speakers are. They can, however, be exposed to the target language in the form of *appropriate* reading matter.

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