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GUI INTERFACE TO PERFORM FUNCTIONAL CALCULATION OF THE SHALE SHAKER, CLEANING ELEMENT OF THE SYSTEM OF DRILLING MUD

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Abstract: This paper describes the execution and usage methodology offered by MATLAB facilities, by designing a GUI graphical interface used to calculate the dimensional elements of V belt transmission and the perturbing force necessary to achieve the vibratory motion. The paper also covers all stages of spring calculation, as well as cinematic calculation notions concerning the perturbing system.

Keywords: *GUI graphical interface, shale shaker, drilling mud*

The types and quantities of cuttings present in drilling mud system have major role in the fluid's properties as: density, viscosity, filter cake quality and filtration control. Cuttings removal is one of the most important aspects of mud system control, because it has a direct bearing on drilling efficiency.
Cuttings removal on the rig is accomplished by one or more of the following basic methods:

- screening;
- hydrocycloning;
- centrifugation;
- gravitational settling.

A diagram of a typical mud circulating system, including various solids-control devices, is shown in figure 1:

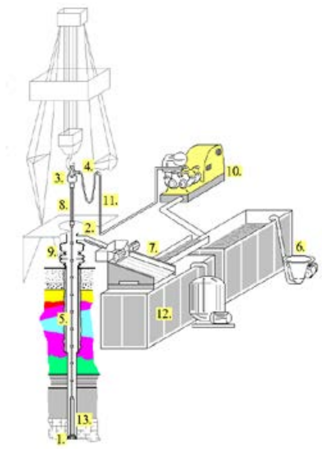

Fig. 1. Drilling fluid circulating system

1 –drill bit ; 2 – flow line; 3 – crown block; 4 – vibrating hose; 5 – drill pipe; 6 – equipment for drill mud preparation; 7 - equipment for drill mud separation of mud pit; 8 – Kelly; 9 – BOP's equipment; 10 – mud pump; 11 – standpipe; 12 - mud tank; 13 – drill collar.

The most important solids-control devices are *shale shakers* .

A shale shaker is a vibrating screen separator used to remove drill cuttings from the mud.
The basic shale shakers types used are:

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- Circular-motion shaker
- Elliptical-motion shaker
- Liner-motion shaker.

Shale shaker performance is affected by the type of the motion, stroke length of the deck and the rotary speed of the motor.
Shale shakers kave a back tank to receive mud from the flowline. The mud flows over a weir and is distributed to the screening surface. The screen is placed over a basket that has a vibratory motion. The basket is mounted on helical springs. Below the basket is used a collection bed to channel the screen underflow to the active system.
Shale shakers are the most important and easiest-to-use solids-removal equipment. A diagram of a typical shale shaker is shown in figure 2.

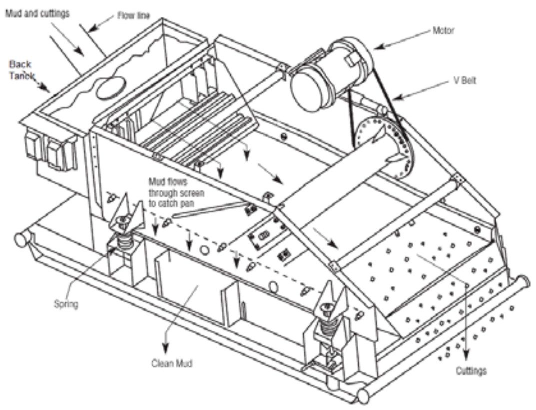

Figure 2 Shale shaker's diagram

Figure 2 presents the active elements of a shale shaker: electric motor, transmission V-belts, shaft vibrator that transmits vibrations to the hopper mounted on helical springs.
The study of this paper is based on sizing V-belt transmission.
Initial data for design are:
- computing power to the drive shaft
- nominal power transmitted by a V-belt
- RPM of V-belt's running wheel
- RPM of V-belt's driven wheel
- driven wheel's diameter
- efficiency of the transmission
- functional ratio of transmission

The graphical interface build in MatlabGUI(figure 1) is using predefined objects available in Matlab, such as:

- 5 objects type Edit Text
- 24 objects type Static text
- 1 object type Push Button
- 1 object typePopup-ul menu

- length ratio
- Winding ratio
- V-belts no. ratio

Shall be calculated:

- transmission ratio:
$$i = \frac{n_1}{n_2}$$
- diameter drive gear:
$$D_{p2} = i \cdot D_{p1}$$
- the average diameter pulley: $D_{pn} = \frac{D_{p1}+D_{p2}}{2}$
- distance between axles pulleys
$$A = 0{,}25 \cdot L_p - 0{,}393 \cdot \left(D_{p1} + D_{p2}\right) + \sqrt{\begin{matrix}\left[0{,}25 \cdot L_p - 0{,}393 \cdot \left(D_{p1} + D_{p2}\right)\right]^2 \\ -0{,}125 \cdot \left(D_{p2} + D_{p1}\right)^2\end{matrix}}$$
- the angle of the branches V-belt: $\gamma = 2 \cdot arcsin\frac{D_{p2}-D_{p1}}{2 \cdot A}$
- winding wheel angle than V-belt
$$\beta = 180° - \gamma$$
- V-belt length:
$$L_p = 2 \cdot A + \pi \cdot D_{pn} + \frac{\left(D_{p2} - D_{p1}\right)^2}{4 \cdot A}$$
- peripheral velocity of the V-belt: $v = \frac{\pi \cdot D_{p1} \cdot n_1}{60 \cdot 1000}$
- finalnumber of V-belts
$$Z = \frac{P_c \cdot c_f}{c_l \cdot c_b \cdot c_z \cdot P_0}$$

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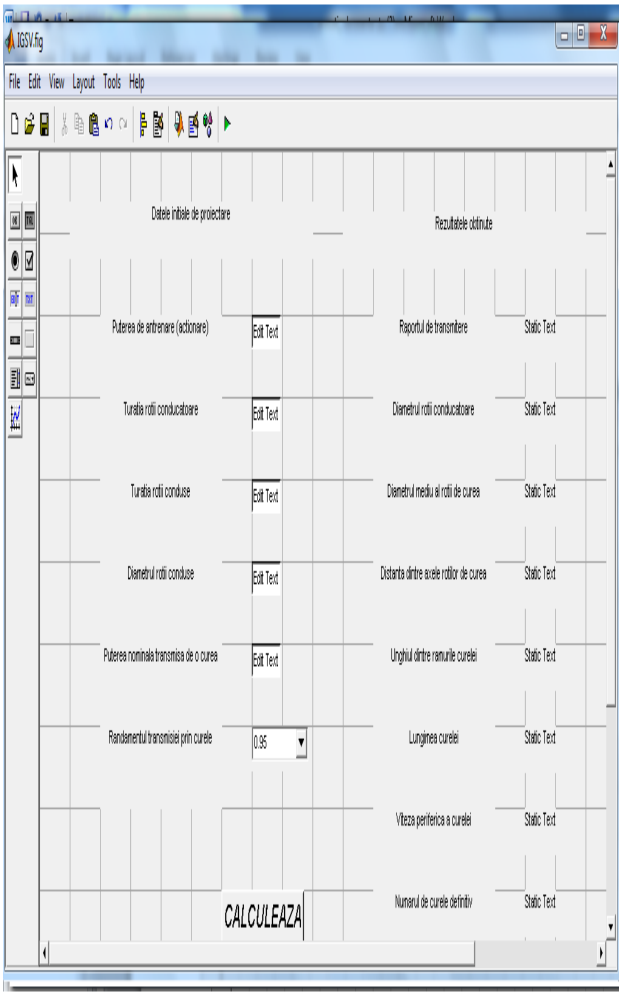

Figure 1 Graphical Interface built in Matlab

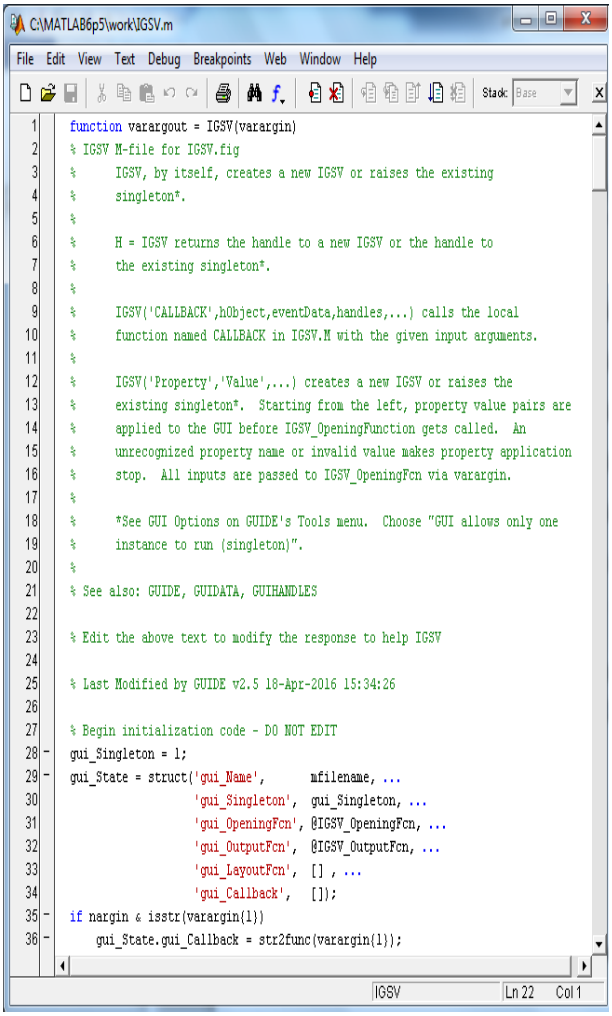

Figure 2 IGSV.m (Source Programm)

GUI, once configured and saved generates two files*IGSV.m* (fig 2)and *IGSV.fig* (fig 3). In the *IGSV.m* file will configure properties of all objects built in file*IGSV.fig*.
Presented GUI is used to calculate the dimensional elements of V belt transmission, according to the algorithm presented in this article. The result is displayed by running the file *IGSV.m* and then after opening *IGSV.fig*. will obtain window from Figure 4. Here are entered from the keyboard initial design data.

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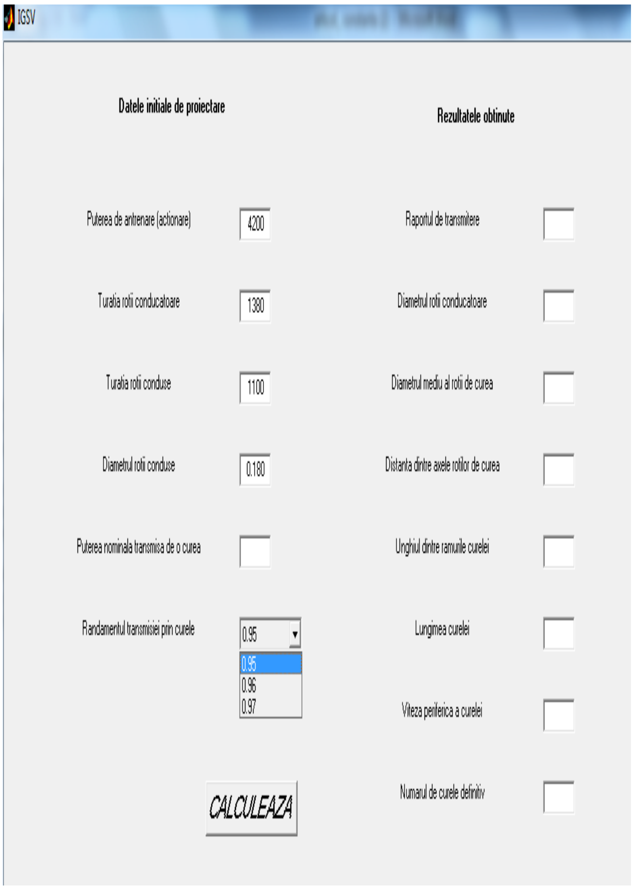

Figure 3.IGSV.fig generated from the GUI (Initial Data Input)

The elements of V-belt transmission are calculated after pressing button *CALCULEAZA,* and values will be returned as shown in Fig 4.

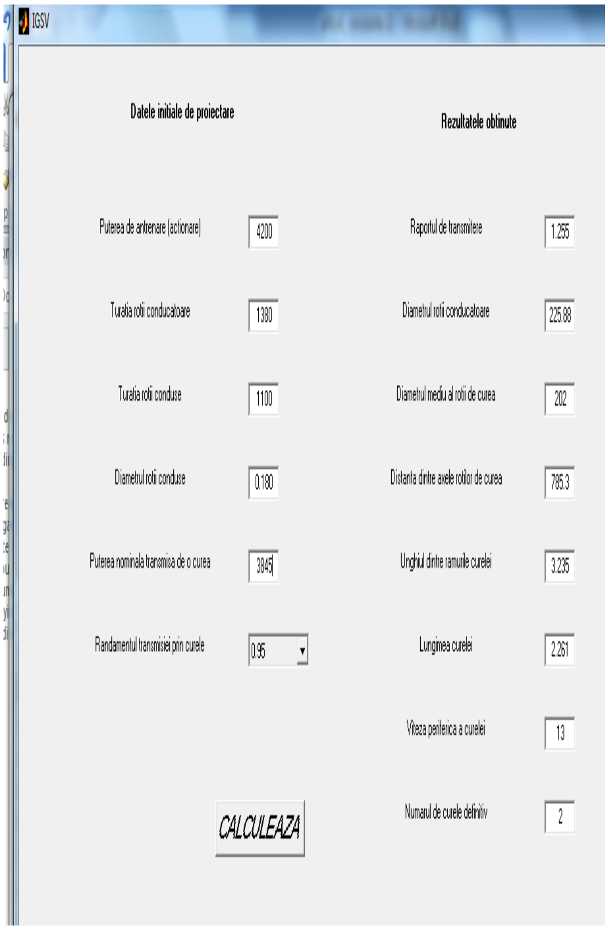

Figure 4.IGSV.fig generated from the GUI (Results Obtained)

CONCLUSION

Using the facilities offered by this programming environment are useful and functional helping for calculation of shale shaker's parameters. This article is the first stage of calculation, the purpose being to achieve a graphical interface that covers the calculation of all components of the cleaning system of drilling mud by creating multiple windows work.

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