RESEARCH LABORATORY HYDROACUSTICS AND VIBRATIONS

Bruel&Kjaer is a leading company worldwide and the instruments and software produced by them are precise and offer reliable data in area of noise and vibration measurement and analysis.

The following equipment is in Research Laboratory Hydroacustics and Vibrations: - PULSE. Machine Diagnostics Toolbox Type 9727

- Data acquisition system LAN XI

- Power amplifier type 2713

- Laptop with PULSE 14 software

- 3 hydrophones type 8106

- 2 hydrophones type 8104

- 5 accelerometers type DeltaTron 4506 and 752A 12x

- 5 coaxial cables of 100 m

- 2 coaxial cables of 10 m

- Calibrator type 4229

- Ansys:Workbench, Mechanical APDL (25 licenses + 1 research license);

- Solidworks, Solidworks Simulation, Floworks (20 licenses + 1 research license);

- Matlab (10 licenses);

Hydrophone type 8106 is a wide-range, general-purpose transducer for making absolute sound measurements over the frequency range 7Hz to 80 kHz with a receiving sensitivity of -174dB re1V/µPa. The hydrophone is capable of withstanding high static pressure, the operational upper limit being 107 Pa (100 atm.; 1000 m (3250 ft.) ocean depth). A built-in high-quality, thick-film, low-noise, 10 dB preamplifier provides signal conditioning for transmission over long underwater cables. The preamplifier features a 7Hz high-pass filter and an insert-voltage calibration facility, but does not allow the hydrophone to be used as a projector. An integrated watertight connector allows quick disconnection of the cable and makes replacements and storage very easy.



Figure 1. Components of the hydrophone type 8106

Hydrophone type 8104 is a wide-range standard measuring transducer for making absolute sound measurements over the frequency range 0.1Hz to 120 kHz with a receiving sensitivity of -205dB re 1V/µPa. It can also be used as a sound transmitter (projector) which makes it ideal for calibration purposes by the reciprocity, calibrated-projector and comparison methods.



Figure 2. – Components of the hydrophone type 8104

The Power Amplifier type 2713 is designed specifically to drive highly capacitive transducers to high voltage levels, such as when the Brüel&Kjær Hydrophones Types 8103, 8104 or 8105 are employed as projectors in underwater calibration arrangements. It has a frequency range from 10Hz to 200 kHz with a maximum gain of 60 dB in 10 dB steps with continuously variable gain in each range. Switchable voltage limits of 100 V

(RMS), (141 V (peak)) for reactive loads, 75V (RMS), (105 V(peak)) for resistive loads, or 31,6 V (44,7V (peak)) for both reactive and resistive loads can be selected to protect the particular transducer being employed.



Figure 3. – The power amplifier type 2713

LAN-XI Data Acquisition Hardware is a versatile system of modular hardware that can be used as a stand-alone, single-module front-end, as part of a distributed module setup, or collected in 11-module frames. The hardware is fully compatible with IDA^e hardware for PULSE and works with both PULSE and Test for I-deas. The individual modules have a very rugged industrial design, perfect for use in the field, and at the same time are plug and play modules that you can easily reconfigure in different setups. Running on AC, DC or Power over Ethernet (PoE) and with interchangeable front-panel connectors, LAN-XI hardware provides an extremely flexible system: scalable from 2 to more than 1000 channels with a frequency range of 51.2 kHz and an unlimited data transfer capacity.



Figure 4. - LAN-XI Data Acquisition Hardware

PULSE. Machine Diagnostics Toolbox Type 9727-X includes the multichannel PULSE data acquisition unit Type 3560-B and a Dell notebook PC packaged in a ruggedized and weatherproof carrying and connector case and WU-0642 yellow suitcase (BNC/T connect).

Type 7700 is a bundle of PULSE application software dedicated FFT/CPB analysis, 1-5 channel and 7708 is PULSE Time Data Recorder 1-5 channel.



Figure 5. - PULSE. Machine Diagnostics Toolbox Type 9727

PULSE is Brüel & Kjær's platform for noise and vibration analysis and it was built on over 60 years of measurement experience and innovation. PULSE 14 is release by B&K and the base measurement software is FFT Analysis and CPB Analysis.



Figure 2.5. – Screen capture of Bruel & Kjær's PULSE

A convenient calibration check at low frequencies can be performed using Brüel&Kjær Hydrophone Calibrator Type 4229 (the sensitivity of a hydrophone is the same in air as in water for low frequencies). This provides a rapid and easy method for air calibration of sound measuring systems terminating in Brüel&Kjær Hydrophones. Type 4229 is battery powered and can be used both in the laboratory and in the field. The principle of operation of the 4229 is the production of a sound pressure in the coupler cavity by four pistons which oscillate back and forth in phase. A frequency of 251.2Hz is produced which is electronically maintained within $\pm 0.1\%$. The 8106 hydrophone is calibrated with the coupler WA0658.