



# Politechnika Wroclawska

## System for dynamic measurements of giant engineering structures, Wrocław

*In the end of 2007, a 34 channel PULSE system has been delivered for the purpose of versatile measurement tasks related to the analysis of dynamic properties of giant engineering structures. The owner of the instrumentation is Instytut Inżynierii Lądowej Politechniki Wrocławskiej (Institute of Civil Engineering, Wrocław University of Technology). The application is the result of many years of efforts and preparations, eminently fitting to the current dynamic development of the town of Wrocław and its educational centers. This way Poland faces totally new quality of the measurements to be performed in buildings and other engineering structures.*

*The major features of the instrumentation and its owners are shown below.*

The system can be divided into two independent parts, each of 17 input channels, all featuring the frequency range of DC to 25,6 kHz and 12 additional auxiliary channels. The separate power supply units enable using 110 - 240 V AC, 10 – 32 V DC, built – in batteries, external power packs and portable, petrol driven generators.

Two sub-systems, equipped as above, can be connected and synchronised using a fiber-optic line. By doing this, a distributed, 34 channel system can be set up, with its two parts located up to few hundreds meters away from each other. The inputs are then still synchronized and phase matched. The concept of this solution has been developed by engineers from Politechnika Wroclawska and then applied by Brüel & Kjær together with one of the Polish partners, a design expert in the field of instrumentation, intended to be used in harsh environment or typical field conditions.

All instruments have been closed in a number of environmentally protected suitcases, designed to be hand carried by a single person. To perform the measurements in a certain scenario, one takes only the necessary components, while the rest can be left at the office. The whole setup is supplemented with rugged, laptop type computers, featuring special displays, clearly visible in all conditions (including full sunlight). Being based on type 3560 PULSE system and its Dyn-X acquisition modules, all inputs reach the dynamic range of 160 dB with ideal linearity and phase matching. All of this, together with TEDS technology and the extensive diagnostics of the input chain condition, makes the data acquisition practically unattended, mostly because of no need to control the input range settings anymore.

Additionally, the system has been equipped with transducers and accessories, intended for a purpose of experimental Modal Analysis: accelerometers, small and sledge impact hammers, shakers, calibrators etc. The performance of those has been supplemented by a laser vibrometer, equipped with a shooting telescope, a set of seismic accelerometers, Class 1 measuring microphones and a dedicated system for human vibration evaluation in vehicles, buildings and work places.

The software provided enables to record the measured signals, in parallel to the real time analysis or separately for further post processing, as well, as different kinds of analysis ranging from Machine Diagnostics and Monitoring, Modal Analysis, Noise Measurements and Monitoring, through Sound Power, Order Tracking (with and without tacho signal), finally up to Human Vibration evaluation.

Special attention shall be paid to the Structural Analysis package, covering all kinds of Operational Modal Analysis (OMA), Operational Deflection Shapes (ODS) and Classical (shaker, hammer) with structural modifications and simulations. The OMA application has been equipped with all of the newest achievements in that field, including automatic search and detection of mode shapes and also automatic detection and removal of harmonic contents in the measured signal.

The fundamental task for this system is to serve the projects for the industry and the construction sector, especially the issues related to raising and maintenance of giant engineering structures, such as buildings, bridges, production facilities, as well, as environmental considerations, hygienic research and education.

Interested? Kindly invited to cooperate with:

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**Brüel & Kjær**