CALIBRATION OF KNOCK SENSOR

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ABSTRACT

This paper deals with the description of calibration of knock sensors for automobile industry. The main goal is to measure the frequency response function of the knock sensors using multianalyzer PULSE 3560C. This calibration method is characterized by excellent accuracy, repeatability and automated testing.

1 INTRODUCTION

A knock sensor (Fig. 1) is an acceleration transducer for ignition systems, which incorporate knock control. A knock sensor uses a piezoelectric element to measure the inertial forces exerted upon seismic mass (see scheme in Fig. 2). Knock sensors play a dual role on engines. Like other sensors, knock sensors monitor engine operation to optimize performance. In addition, knock sensors protect the engine against power-robbing, and potentially destructive, engine knock. The typical frequency range and vibration amplitude are from 5 kHz to 15 kHz and approximately 100 m/s^2.

Fig. 1: *Knock sensor*

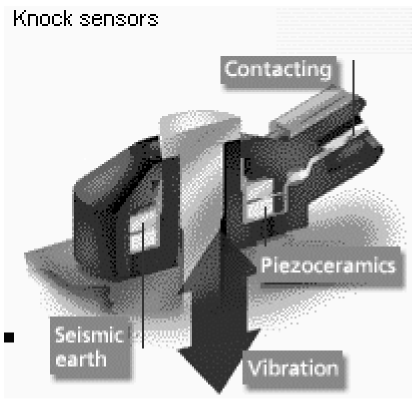

Fig. 2: *Scheme of knock sensor*

2 MEASURING TECHNIQUE

Tests included measurement of the frequency response of knock sensors. The knock sensor attached to the shaker (Fig. 3) was actuated with the random noise in the frequency range from 3 kHz to 15 kHz. Fourier spectrum of the signal was scanned by means of knock sensor mounted on the shaker and the reference accelerometer itself. The frequency response is calculated as the ratio between measured spectrum of knock sensor and reference accelerometer. Fig. 4 shows the typical frequency response of a knock sensor.

Fig. 3: *Detail of gripping knock sensor to shaker and gripping reference accelerometer*

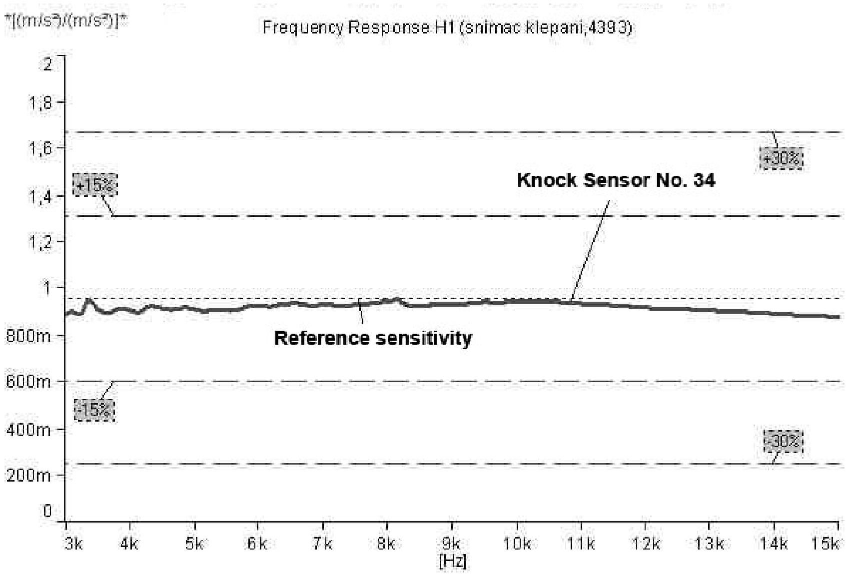

Fig. 4: *Typical frequency response of tested knock sensor*

Multianalyzer PULSE 3560C, supported by program accessories PULSE LabShop version 7.0 over LAN interface, generates signal for a shaker actuation and at the same time controls acquisition and evaluation of measured data (see Fig. 5). Four-channel configuration analyzer, supporting the transducers with built-in electronic data sheet and satisfying specifications IEEE P1415.4, in connection with powerful computer equipment (PC with Intel CPU 1.6 GHz, RAM 500 MB – Fig.6) handling necessary power and accuracy of measurement. For acceleration measurements (vibrations) piezoelectric accelerometer Brüel & Kjaer type 4393 has been used.

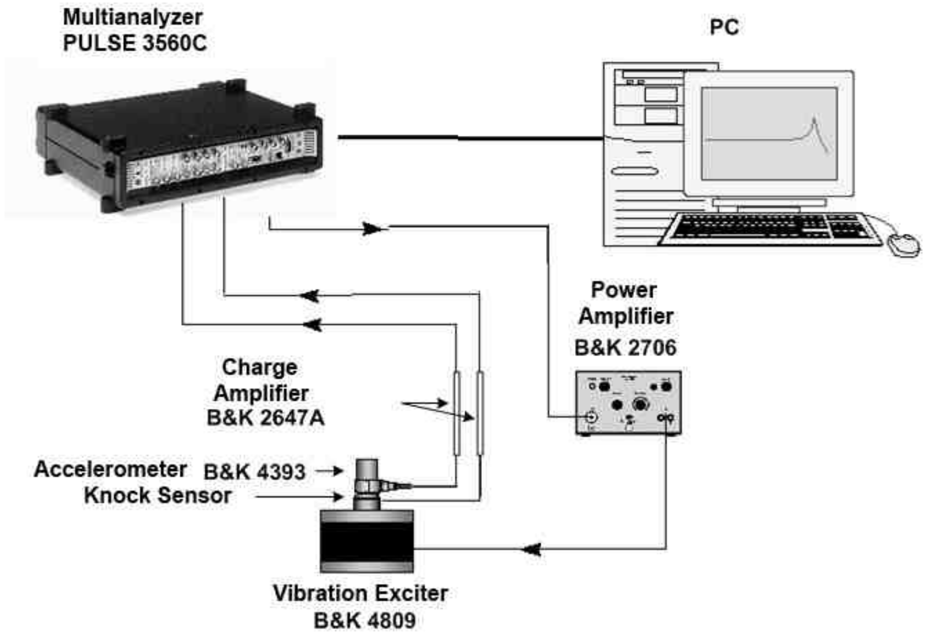

Fig. 5: *Schematic diagram*

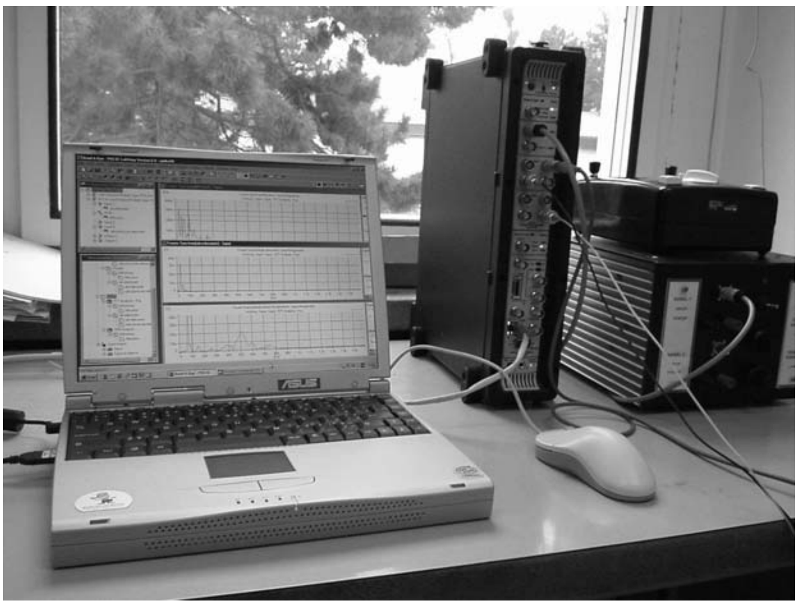

Fig. 6: *Measuring configuration*

3 RESULTS AND DISCUSSION

The frequency response of whole knock sensor to the noise vibrations in the frequency band from the 3 kHz to 15 kHz is shown in Fig. 4 and Fig. 7. Measured results were statistically processed and correlated with data from producer. The experiments indicate that measurement of properties of the knock sensor by means of the frequency response are repeatable and objective and may be used for calibration of this sensor.

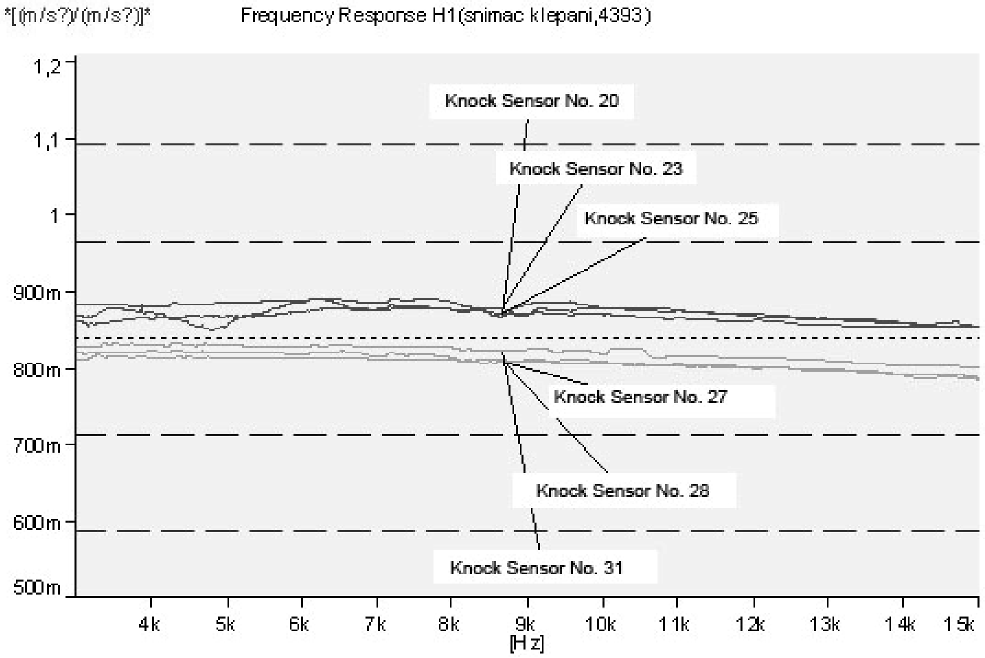

Fig. 7: *Tests of different knock sensors*

4 CONCLUSION

The measurement was realized in specialized laboratory of vibroacoustics. The results show that it is possible to use the proposed method for testing knock sensors. The advantages of this test procedure are in accuracy and repeatability and automated testing.

ACKNOWLEDGEMENTS

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