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Noise mapping inside a car

V A Strekalov, R R Shaimuhametov

Kazan Federal University, 18 Kremlyovskaya street, Kazan, 420008, Russian Federation

ramil.shai@mail.ru

Abstract. We present new wireless sensor telemetry system designed to be mounted on different nodes of the car and record acoustic noises. The proposed system is mapping noise inside a car. The noise field is recorded at the ten control regions simultaneously.

The research of the noise inside a car has several aspects:

1. The noise as an environmental factor for the environment;
2. The noise affecting the performance of the staff affected by them.

The amplitude and frequency characteristics of the noise are considered international and Russian standards, technical specifications and other regulations (for example, "Rules №51» UNECE GOST R 41.51 - 2004 "UNIFORM PROVISIONS CONCERNING THE CERTIFICATION OF VEHICLES HAVING AT LEAST FOUR WHEELS WITH REGARD TO NOISE ", etc.).

Automotive companies conduct numerous tests to study the causes of noise and methods to combat them.

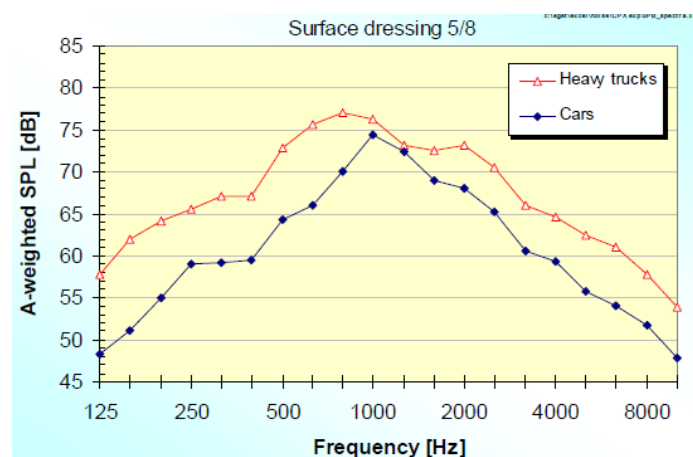


Fig. 1. The noise of the vehicle.

Fig. 1 shows the spectra of the movement of noise in dB for the frequency band from 125 to 8000 Hz to 80 km / h speed (cars), 70 km / h (trucks) [1].

The equipment used to measure noise in tasks, can be divided into two groups:

1. Measuring noise sound volume level (in dB);
2. The noise spectrum measurement systems (frequency response).

The second group of equipment allows, inter alia, create a "map" to locate the source of the noise, the noise detection reasons drafting a "model" of the spectrum individual node noise.

In the Engineering Institute of the Kazan Federal University to an end the work on the "map" of the vehicle noise. In the original equipment developed with 10 microphones installed in different nodes of the machine removed noise spectra [2].

Fig. 2 shows the arrangement of microphones and noise of individual nodes.

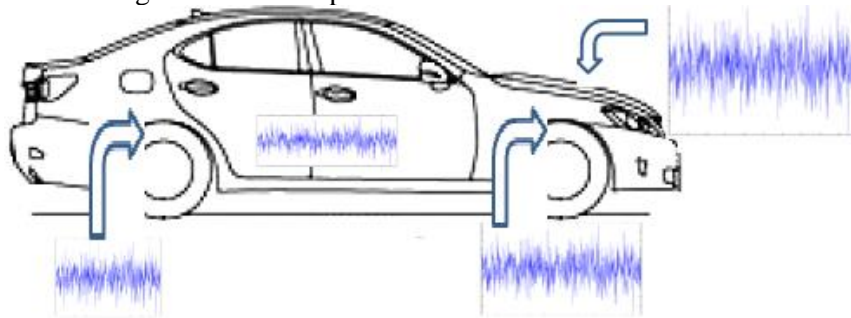


Fig. 2. The spectra of noise on the individual nodes of the vehicle (speed of 70 km / h, asphalt).

The developed equipment allows:

- Carry out spectral and correlation analysis of audio signals with one hundred sensors in the range of 50 Hz - 15 kHz. (ADC sensor to the microcontroller 30 kHz).
- Transfer the data from the sensors to the computer for the unlicensed 433 MHz. transmission channel provides reliable transmission of all the sensors from the vehicle compartment.
- The system-on-chip CC1111 [3] allows to perform advanced signal processing: filtering, spectral analysis.
- To conduct a full analysis on the computer, which may be located far away (100 m) from the object with sensors. The software allows to perform spectral and correlation analysis of acoustic signals.

A low-power system-on-chip (C1111, Texas Instruments, USA) based wireless body area network was developed to achieve parallel recording of acoustic signals. The sensors [4] units are incorporated with 433-MHz RF transceiver, programmable gain amplifier, and microphone to collect the acoustic data and send it to base station through wireless transmission.

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