

Tomasz Nowakowski, M.Sc. Eng.

Abstract

DEVELOPING A METHOD FOR ASSESSING THE VIBROACOUSTIC ACTIVITY OF A TRAM BASED ON TRACKSIDE MEASUREMENTS

The PhD dissertation was focused on the issue of developing a methodology for assessing the vibroacoustic activity of trams based on trackside measurements during pass-by test. The work is divided into four main parts consisting of thirteen chapters in total. The dissertation presents the sources of vibrations and noise generated by trams and their impact on the environment. The concept of vibroacoustic activity was defined along with the division into its four main components.

The research problem, the aim and scope of the dissertation were described in following dissertation part. Basic assumptions of the developed method were indicated. Research object selection and methodology are presented in the next section. Seventeen measurement points covering the area of the track infrastructure and its surroundings were used in the vibroacoustic tests.

The diagnostic aspect of selected vehicle components are developed in the dissertation. A method of gear diagnostic and wheel-flat detection were elaborated. Analysis of six point values representing acoustic phenomena with five psychoacoustic indicators were presented. Also, analysis of four point vibration values were showed. The analysis was carried out in terms of statistics, including correlation and regression analyzes, linear and non-linear modeling, examination of distribution characteristics, or calculation of permissible and limit values. The machine learning method was also used to extract groups of observations using a combination of normal models. Then, the vibroacoustic activity index was calculated based on multi-criteria analysis which was elaborated from point values. The possibility of assigning priority to individual point values in the index calculations was also presented. The individual tram passage were classified into five classes in terms of the described index. The possibility of observing the index trend in time period for the tested trams was specified. To sum up, conducted dissertation allows to create a database on the current technical condition of trams in terms of vibroacoustic activity.

The dissertation results enable the implementation of the developed method in operational conditions. A software interface for the results visualization from the applied algorithm was also presented. Conclusions from the conducted research were presented. At last but not least, the directions of further work in the field of vibroacoustic activity assessment of trams were defined.

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mgr inż. Tomasz Nowakowski