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ON-BOARD MONITORING OF THE TECHNICAL CONDITION OF ROLLING STOCK USING EFFECTIVE INFORMATION TECHNOLOGIES

Candidate of Technical Sciences V.P. Nerubatskyi, D.A. Hordiienko
Ukrainian State University of Railway Transport (Kharkiv)

Increasing the efficiency of the maintenance and repair processes of traction rolling stock based on the use of new information technologies and expert decision support systems makes it possible to achieve the required indicators of operational reliability and productivity of locomotives, while ensuring a reduction in the costs of performing maintenance and repair activities [1].

A modern solution to this problem is the transition to a promising system of predictive repair of traction rolling stock [2]. Predictive repair is the repair of identified pre-failure conditions and prediction of their occurrence based on the presence of trends in monitoring and diagnostic parameters. The main effect of such repairs is to reduce expensive unscheduled repairs and failures of locomotives in operation, and, consequently, downtime. It is obvious that success in the field of predictive repair is impossible without significant development of on-board measurement systems using effective information technologies [3].

Locomotives of old series or mass-produced ones are equipped with on-board microprocessor control systems, which have two key properties that are important for organizing predictive repairs: firstly, sets of standard sensors, flow meters, sensors and control devices, secondly, means of reading, storing, processing and transmission of received information. All this makes it possible to carry out continuous or discrete measurement and recording of values of a large array of analog and discrete parameters of equipment operation (Fig. 1).

The use of control and diagnostic data from on-board microprocessor control systems to organize a predictive repair system allows for continuous or periodic monitoring of the parameters of locomotive systems and equipment. Based on this, for each specific traction unit, a corresponding set of maintenance or repair actions of various levels and volumes is formed.

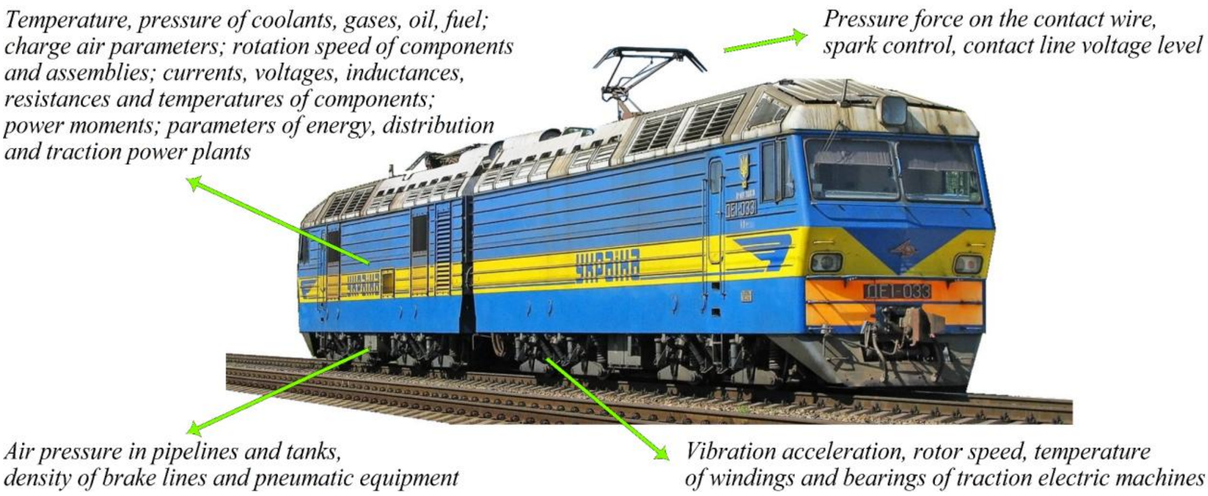

Fig. 1. Parameter control by microprocessor control system

The microprocessor control system stores the data obtained during the monitoring process, which allows the use of advanced methods for monitoring technical condition and analyzing data in real time. Depending on the results obtained, a forecast of the technical condition of the equipment is drawn up and maintenance and repair programs are formed. When implementing this approach, the probability of failures of locomotive systems and equipment should be minimized.

The microprocessor control system in the predictive repair system has the following specific tasks:

– collection of a package of data from measuring instruments obtained both from operational impacts on the locomotive and from test impacts on its equipment and systems;

– performing operational monitoring of the condition and operating modes of the locomotive as a traction unit;

– implementation of functions of continuous or discrete monitoring and diagnostics of technical condition;

– accumulation of an appropriate statistical database, including on operational failures.

Thus, the onboard microprocessor control system, firstly, records the amount of work actually performed by the locomotive and violations of operating conditions, and secondly, and most importantly, determines the actual technical condition of the locomotive as a set of parameters and their trends characterizing the correct functioning of the equipment and operability of the locomotive, serviceability of components and equipment. At the next stage, based on the data on the work performed by the locomotive and its technical condition, the date the locomotive is scheduled for maintenance or repair is determined. Resources for repairs are generated based on data on the volume of work performed and data on the actual condition of the locomotive. Based on the required resources, material and technical support for maintenance and repair activities is organized.

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[3] Barabash O., Shevchenko H., Dakhno N., Kravchenko Y., Leshchenko O. Effectiveness of targeting informational technology application. *2020 IEEE 2nd International Conference on System Analysis & Intelligent Computing (SAIC)*. 2020. P. 1–4. DOI: 10.1109/SAIC51296.2020.9239154.

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APPLICATION OF TECHNOLOGIES BASED ON DISTRIBUTED ACOUSTIC SENSING ON RAILWAY TRACKS

Candidate of Technical Sciences V.P. Nerubatskyi, D.A. Hordiienko
Ukrainian State University of Railway Transport (Kharkiv)

Currently, a number of developed railways are paying increased attention to monitoring technologies based on distributed virtual acoustic sensors in optical fiber. The use of technical solutions based on fiber bragg grating (FBG) has confirmed the fundamental suitability of fiber optic technologies for detecting the passage of rolling stock wheels [1, 2].

FBG technology involves the formation of a periodic structure in an optical fiber using a laser signal source, which has the properties of a reflector for wave pulses of a certain length [3]. High-frequency light pulses are transmitted into the fiber-optic cable, followed by evaluation of the reflected signal. Sound vibrations and vibrations cause changes in the intensity of the backscatter signal in real time (Fig. 1).

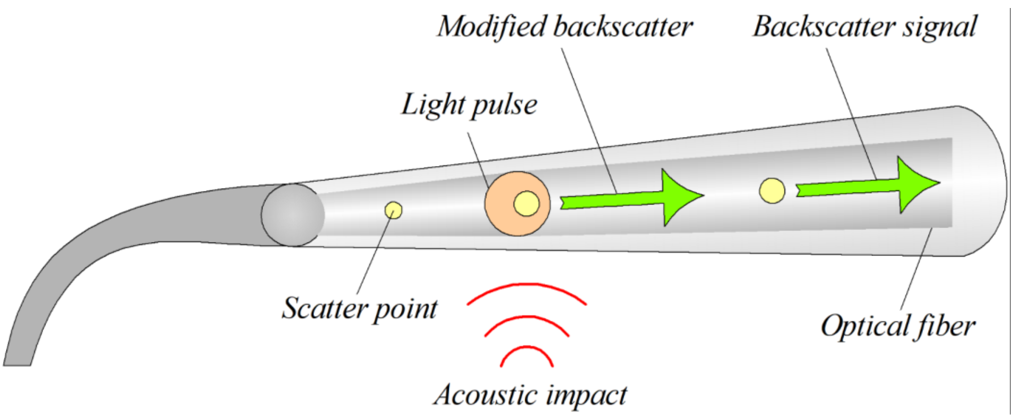

Fig. 1. Operating principle of distributed acoustic sensing

The reflected wavelength λB is affected by any variation in the physical or