KNOWARE OF TROUBLESHOOTING SYSTEM: FROM BAYES RULES TO ANALYTIC NETWORKS

Sarkisyan, Rafael E. – D.Sc. (Tech), professor of Moscow State University of Railway Engineering (MIIT), Moscow, Russia.

Stadnichenko, Stanislav Yu. – Ph. D. student of Moscow State University of Railway Engineering (MIIT), Moscow, Russia.

Masalida, Alexandra V. – certification expert of Siemens LLC, Moscow, Russia.

Troubleshooting problems are especially valuable for automatic systems controlling the traffic of rolling stock in real-time as well as for the systems used during stationary maintenance, part replacement and repair planning.

Modern information and intelligent technology permit to combine the tasks of troubleshooting, forecasting and controlling within the integrated system of decision support (particularly DSS – Decision Sprout Systems).

The researches on troubleshooting in rail transportation are rare but important to ensure sustainable and safe high speed traffic and other railway operations. Operating conditions of locomotives change under the influence of internal and external factors. The technical troubleshooting should prevent risks and identify errors and faults.

The use of different types of models and software of mathematical support of automatic systems permits to achieve sufficient level of diagnostics.

Russian railways use automatic systems of train control, for instance a system of automatic conducting of passenger trains (SAVP). The system permanently controls the conditions of all controlling devices, pressure in the mains, electric current in the circuits etc. The subsystem of troubleshooting is an integral part of the SAVP system.

However, there are some unstructured and less formalizable tasks as a necessity to use heuristic information, ambiguity of data and of decision-making, limited time periods to find solutions, interactive course of decision making.

Traditional methods of extraction and processing of information are not very suitable, and Bayes technique and rules, mathematical models that allow to consider internal links between the processed data and devices, are more promising.

There is an assumption that stochastic apparatus helps to proceed with hypotheses on the impacts under indeterminacy so that the methods and computation there-of can be carried out by formalization called analytic networks [5, 6]. If there is a little number of signs under revision, then the number of experiences in order to get statistically reliable information should be rather big. So it is necessary to use for troubleshooting some generalized models which contain statistical data as well as expert's judgments.

The aim is to obtain an assessment of a posteriori probability that the observation indicates the searched condition. This objective can be achieved if there is an assumption that the object under the control is exhaustively described by a set of parameters which represent a vector of description. The totality of all possible values of the vector is a space of description of the object. Every condition is conform to some accessible region of values with the parameter between them. If the regions and consequently the conditions are determined then the problem of troubleshooting is reduced to decision-making in favor of a certain condition every time that the description of parameters enters the accessible region of values.

To ameliorate this rule of troubleshooting it is possible to add a function describing the cost of a wrong decision

The structure of troubleshooting problem is based on the idea of a method of analytic networks.

The objective of the study of that network structure is to assess the priorities of its elements with the account for interlevel and intralevel links and influences. According to the general theory of Analytic Hierarchy Process the study is reduced to engineering and processing of super matrix W1 (with the elements of ordinate matrix).

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