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# GENERALIZED CRITERION OF EFFICIENCY DIAGNOSIS

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***Abstract.*** *The paper considers the possibility of applying a number of criteria that are used to quantitatively assess the effectiveness of diagnosis. The obtained results can be used as initial data for setting and solving a number of operational reliability management tasks and diagnostics of urban electric transport vehicles, in particular, for evaluating the effectiveness of diagnostics for practically any technical object.*

***Key words:*** *diagnostic complex, technical subsystem, diagnostic efficiency criterion, operator, diagnostic object, diagnostic system, controlled part.*

## Introduction.

There is a known set of criteria that are used to quantify the effectiveness of diagnostics. However, the choice of one or another criterion is a rather difficult task, which is explained by the need to simultaneously take into account the quality of the functioning of the diagnostic equipment, the technical and economic possibilities and the economic feasibility of the diagnosis. Usually, the following requirements are set for the selected criterion:

1) the need to record the technical indicators of both the object and diagnostic tools;
2) the possibility of comparing various diagnostic tools and determining ways to improve their technical indicators;
3) ease of calculation when performing engineering calculations.

## Main text.

Most of all, these requirements are satisfied by the so-called generalized criterion of diagnostic efficiency ($E_{еф}$), which takes into account the influence of all components of the diagnostic complex: the operator (О), object of diagnosis (ОД) and technical means of diagnosis (ТЗД). Figure 1 shows the structure of the diagnostic complex. Probability is chosen as a generalized criterion $E_{еф}$ performance of the tasks assigned to it by the object. According to the general structure of the diagnostic complex (ДК) (Fig. 1):

$$E_{эф} = W_{Д}\rho_1 \ , \qquad (1)$$

where $W_{Д}$ - the probability of correctly determining the state of the object;

$p_1$ - the probability of the absence of malfunctions in the uncontrolled part (НКЧ) object of diagnosis (ОД) over time $T_1$.

In turn, the probability $W_{Д}$ depends on diagnostic tools (ЗД) and operator activity (О):

$$W_{Д} = V_1V_2 \ , \qquad (2)$$

where $V_1 i V_2$ - probabilities of the correct assessment of the state of the object, which are determined by the technical means and the activity of the operator, respectively.

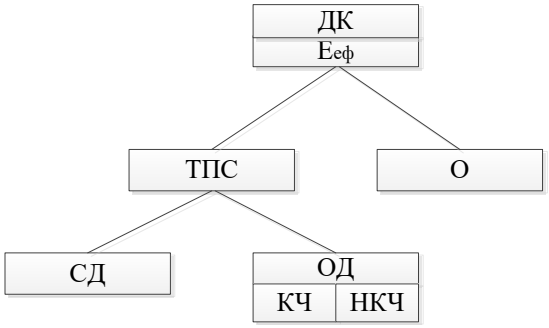


**Figure 1 - Structure of the diagnostic complex:**
*ДК – diagnostic complex; ТПС – technical subsystem; $E_{ефф}$ – diagnostic efficiency criterion; О – operator; ОД – object of diagnosis; СД – diagnostic system; КЧ – controlled part; НКЧ – uncontrolled part*

This approach to assessing the effectiveness of the diagnostic process allows you to build a hierarchical tree of indicators, taking into account the impact on the effectiveness of all components of the diagnostic complex. A similar tree is shown in fig. 2 and has six levels (I-VI).

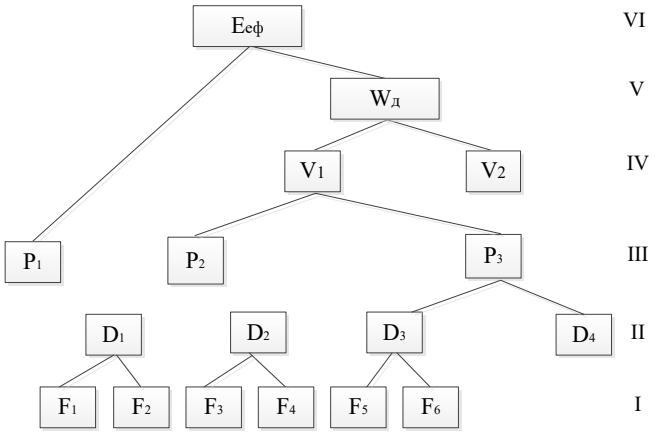


**Figure 2 – Hierarchical tree of diagnostic performance indicators**

Each of the components $V_i$ can depend on several values. So, for example, the value $V_1$ is determined by the reliability of the diagnostic result and the quality of the functioning of the tools used, i.e

$$V_1 = \rho_2 \rho_3 \ , \tag{3}$$

where $\rho_2$ - reliability of the diagnostic result;

$\rho_3$ - the probability of the correct functioning of technical means during the period of control over the state of the object.

Each of $\rho_R$ is also determined by several values. So the reliability of the diagnostic result:

$$\rho_2 = D_1 D_2 \ , \tag{4}$$

where $D_1 \text{ і } D_2$ - methodical and instrumental reliability of diagnosis.

Thus, the probability of correct functioning of technical means $\rho_3$ is determined by the failure rate and availability of the technical means used in the process of

diagnosis. Similarly, each of the indications $D_m$ is broken down into separate components $F_i$ characterizing their individual aspects.

For example, methodical reliability of diagnosis:

$$D_1 = F_1 F_2 \ , \tag{5}$$

where $F_1$ і $F_2$ – reliability of the algorithm and diagnostic method.

Naturally, the number of indicators and their meaning may change depending on the specifics of the diagnostic complex. However, it is essential that a similar approach can be used to assess the effectiveness of diagnostics for almost any technical object.

**Summary and conclusions**.

The possibility of applying a number of criteria that are used to quantitatively assess the effectiveness of diagnosis was considered. It was established that the number of indicators and their meaning can change depending on the specifics of the diagnostic complex.

It is proven that the choice of one or another criterion is a rather difficult task, which is explained by the need to simultaneously take into account the quality of the functioning of the diagnostic equipment, the technical and economic possibilities and the economic feasibility of the diagnosis.

However, it is essential that a similar approach can be used to assess the effectiveness of diagnostics for almost any technical object.

**References**

1. Shavkun, V. M. (2018). Perspective directions of development of methods and means of technical diagnostics of electric transport. Municipal economy of cities: Series: Technical sciences and architecture. Scientific and technical Sat, 1, 58-63.

2. Pavlenko, T. P., Shavkun, V. M Scurihin, V. I., Lukashova, N. P. (2018). Methodology of determining the parameters of traction electric motor failures when operating trolleybuses. Science and progress of transport. Bulletin of Dnipropetrovsk National University of Railway Transport. Academician V. Lazaryan, 4, 47-59.

3. Pavlenko, T., Shavkun, V., Petrenko, A. (2017). Ways to improve operation reliability of traction electric motors of the rolling stock of electric transport. Eastern-European Journal of Enterpraise Technologies, 5, 22–30.

4. Shavkun, V. M. (2014). Diagnosis of traction electric machines of electric transport. East European Journal of Advanced Technologies, 1/7, 48 - 52.

5. Kolcio, K., & Fesq, L. (2016). Model-based off-nominal state isolation and detection system for autonomous fault management. IEEE Aerospace Conference Proceedings.

6. Krobot, Z., Turo, T., Neumann, V. (2017). Using vehicle data in virtual model for maintenance system support. 6th International Conference on Military Technologies, 171–174.