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FEATURES OF PHYSICAL AND MATHEMATICAL MODELING OF TECHNICAL SYSTEMS IN MODERN CONDITIONS

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Abstract. The paper examines the peculiarities of the application of physical-mathematical modeling methods for solving applied problems of optimizing the parameters of technical systems. This made it possible to propose an effective approach to the optimization of a number of simulated systems.

The rapid development and application of information technologies in all areas of human activity requires the development of new and improvement of already existing methods of mathematical modeling. As shown in the articles [1–3], in order to increase the accuracy, speed of calculation and optimization of the parameters of complex systems, it is necessary to propose generalized approaches for the calculation and optimization of the parameters of a number of simulated systems. This will increase the efficiency of the automation of the design of individual technical systems.

Mathematical models that describe the state of a technical system under the influence of physical field load sources consist of the following structural elements: system limitations, objective function, input and output parameters of the modeled system. Depending on the purpose, mathematical models are divided into calculation and optimization models. Calculated mathematical models are understood as the basic equations that are used to calculate the parameters of technical systems. Optimization mathematical model - formalization of the objective function, restrictions on the objective function and its parameters. Based on the meaningful statement of the optimization problem, an optimization mathematical model with restrictions on the objective function and its parameters is built. These restrictions can be set, for example, based on an expert assessment of the parameters of the technical system. The mathematical model must meet the following requirements: accuracy of the parameters obtained after the implementation of the mathematical model, adequacy of the mathematical model, economic implementation, reliability and universality. Quite often, based on the specifics of the modeled system, depending on the goal of optimization, a more specific optimization mathematical model is specified, which is a partial case of the previously specified optimization mathematical model. In addition, optimization of the values of the objective function and its parameters for the technical system is possible only after the calculation of the values of the objective function, that is, after the implementation of the calculation mathematical model.

The paper examines the peculiarities of the application of physical-mathematical modeling methods for calculating and optimizing the parameters of technical systems, the main requirements for mathematical models are given. This made it possible to note the most problematic places that should be paid attention to during the modernization of physical and mathematical modeling methods in order to increase the accuracy and speed of optimization of the main parameters of technical systems.

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