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CHAPTER 3

THE DEVELOPMENT OF METHODS FOR EVALUATING THE STATE OF COMPLEX TECHNICAL SYSTEMS USING ARTIFICIAL INTELLIGENCE THEORY

ABSTRACT

In this chapter of the research, the methods for assessing the state of complex technical systems using the theory of artificial intelligence are proposed. The basis of this research is the theory of artificial intelligence. The methods aimed at solving optimization tasks, variable solutions are defined in such a way that complex technical systems work at their best point (mode) based on the optimization criteria determined.

In the research, the authors proposed:

– the method of assessing the state of complex technical systems using bio-inspired algorithms;

– the method of finding solutions using the population algorithm of global search optimization;

– the method of finding solutions using the improved algorithm of shoals of fish;

– the method of finding solutions using an improved algorithm of jumping frogs.

Each of the methods was based on canonical optimization algorithms, but they were improved by the authors of this research.

The essence of the improvement of these methods, which is the scientific novelty of each of them:

– taking into account a priori known coefficient regarding the degree of uncertainty of data about a complex technical system and the coefficient determined during the work of algorithms regarding the noise of the data;

– the procedure of deep training of agents of the flock allows, in the presence of reliable data, to significantly reduce the time for decision making;

– the reliability of decisions is improved due to the selection of swarm agents. Selection in each of the algorithms is carried out using an improved genetic algorithm.

A limitation of the research is the need to have an initial condition database complex technical system, the need to take into account the time delay for collecting and proving information from sources of information extraction.

It is advisable to use the proposed approach to solve the tasks of evaluating complex and dynamic processes characterized by a high degree of complexity.