ASSESSMENT OF THE RELIABILITY LEVEL OF POWER SYSTEMS BASED ON STATISTICAL METHODS

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Методика розрахунку надійності енергетичних систем з урахуванням впливу керуючих впливів на основі статистичних методів збирання та аналізу дослідних даних представлена.

The reliability of any object is determined by the ability of a technical system to perform certain required functions under specified operating conditions during a specific period of time without failures in the operation of the technological cycle [1–5]. Reliability studies of thermal power plants can be carried out separately or in combination of the work of functional subsystems. Reliability analysis is a standard tool for design, maintenance and operation of any functional unit. In this regard, it is possible to evaluate reliability indicators using a probabilistic approach.

The main fundamental problem in reliability analysis is the uncertainty in the occurrence and consequences of failures [6, 7]. Reliability has several meanings: probabilistic and deterministic. The probabilistic approach is based on statistical modeling of failures without detailing the causes [8, 9]. The deterministic approach identifies the cause of failure of a subsystem with the possibility of further prevention of repeated failure.

This work presents a methodology for calculating the reliability of power systems taking into account the influence of control actions on the basis of statistical models and experimental data processing methods.

The statistical model of reliability calculation taking into account control actions is based on the following assumptions. In case of failure to achieve the required level or other technical characteristic and identification of the cause of failure, constructive changes are carried out; product improvement is of complex nature, i.e. not only the element, the cause of failure of which is identified, but also other elements of the design, directly related to each other by functional dependence when the product performs the task. It should be borne in mind that changes in the design parameters of finalized elements are connected by correlation dependence with the element, the cause of failure of which is known, and directly affect the output characteristic of this element and thus indirectly affect the output characteristic of the product as a whole. During design and development of a new product, when statistical data are not available, functional dependencies and correlations are determined by calculations.

The control law is selected on the basis of practical considerations, and the desired dynamics of the output characteristic is determined using calculations of the reliability of this characteristic in the form of mean time between failures, failure rate, probability of failure-free operation and other parameters, represented as the change of function in time for a given period of operation. In case of their unrealizability, the control parameters obtained on the basis of the calculated data are corrected by carrying out additional calculations when changing the corresponding calculated parameters or changing the dynamics of the output characteristic, as well as correcting the operating time.

If, after testing the retrofitted assembly or system to the same extent as before the retrofit, there is no failure for this type of retrofit, the retrofit is considered effective. If the failure for this type of rework is repeated, the failed element shall be replaced with a structurally new one and the test procedure shall be repeated.

The results obtained in the work can be used to improve the reliability of heat and electric power generation, including for agricultural machinery.

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