TASKS OF THE INTEGRATED AUTOMATED CONTROL SYSTEM OF THE POWER PLANT

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The operating experience of domestic and foreign thermal power plants and nuclear power plants convincingly indicates that their reliable and economical operation should be ensured by three interconnected control systems:

- a process control system (STU), which ensures the production of electricity of the required quality and within the specified time;
- an economic management system (EMS) that ensures this production at minimal cost;
- a system for diagnosing the state and operating conditions of power equipment (SDU).

The need for the existence of these control systems is determined by the presence of fundamentally different control criteria in the implementation of energy production tasks.

The main tasks and features of these control systems are considered below.

Process control systems (STS)

The criteria for optimal technological control are physical quantities that must be kept constant or change according to a predetermined law (steam pressure and temperature, motor rotor speeds, voltages at different points of electrical circuits, etc.). Objects of technological control are units that take part in the process of energy production. Consequently, technological management is the impact on equipment that produces products (thermal or electrical energy) in order to obtain its required quantity and quality.

The means of influencing the objects of technological control are various technical devices (automatic controllers, computers, etc.), as well as operational personnel.

Creation of STU is a simpler task than creation of EMS and SDU. This is due to the fundamental difference between changes in the state of control objects during technological and economic management. STU causes only reversible changes in the state of the control object. If the causes that caused the change in the state of the control object during technological control are eliminated, then the object can return to its original state. For example, with an increase in the load on the power unit, the pressure of fresh steam in the steam generator of a TPP decreases. The resulting effect of the process control system leads to an increase in the supply of fuel, air and feed water, as a result of which the pressure in the steam generator, which characterizes its state, is restored.

The reversibility of changes in the state of objects during technological control allows you to build STS in such a way that the correctness of their work is checked by returning the control object to its original state. All process control systems return control objects to their original state.

One of the main tasks of process control at power plants is to maintain a continuous correspondence between the amounts of generated and consumed energy. The solution of this problem, for example, at a hydroelectric power station, can be carried out in parts with the help of autonomous automatic control systems (ACS) of the steam generator, turbine and electric generator.

The difference in the objects and tasks of control, regulatory bodies and technical means of automation led to the separate control of the processes occurring in the steam generator and turbogenerator in the pre-block power industry. Autonomous (local) automatic control systems of the steam generator, turbine and generator perform continuous and sufficiently high-quality regulation of individual technological processes, i.e. solve particular optimization problems, but are not intended for solving problems of static optimization of parameters for the power unit as a whole.

NEURAL NETWORK CONTROL OF THE BRIDGE CRANE BRIDGE MOVEMENT MECHANISM SYSTEM

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In recent years, neural networks have been widely used as regulators of control systems with complex kinematic chains. Therefore, research on the application of neural networks for management tasks is relevant.

Synthesis of a neural network control system for a two-mass electromechanical system of a bridge crane carriage movement mechanism, which has high performance quality indicators.

The control system is built according to the principle of subordinate regulation and contains two circuits: the EMF regulation circuit and the current regulation circuit subordinate to it. The closed loop current and EMF are adjusted to the modular optimum.

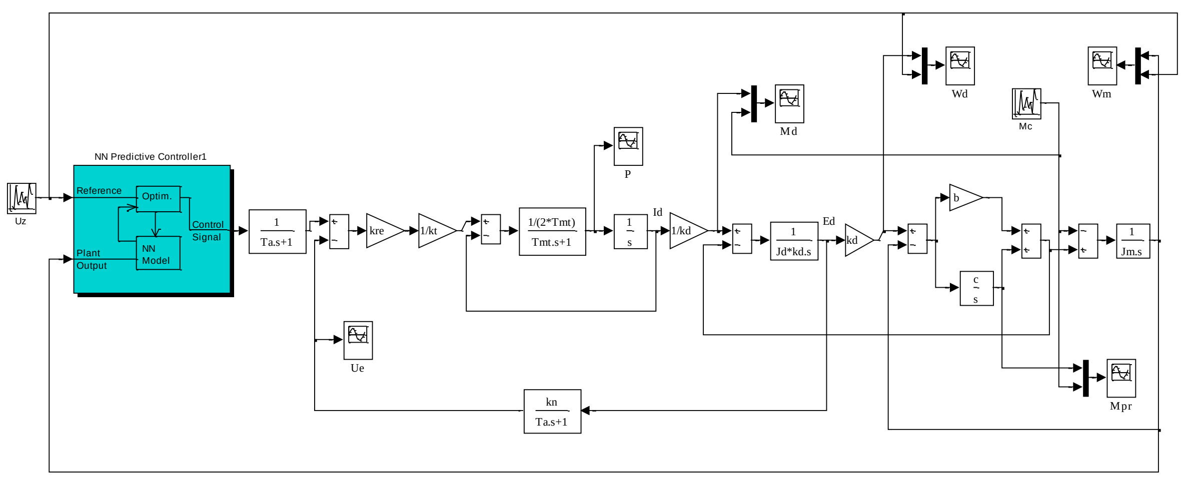

Fig. 1. Scheme of the two-mass system model with the NN Predictive Controller neuroregulator

A mathematical model of the control system was developed, taking into account the rocking of the load in the horizontal plane. The two-mass system was simulated on a computer using the MATLAB application program package. It was established that the transient processes of the state variables of a two-mass system have the character of weakly damped oscillations.

In order to provide the system with the desired indicators of the quality of functioning, the synthesis of the neuroregulator with the NN Predictive Controller forecast, implemented in the Neural Network Toolbox application program package of the MATLAB system [1], was performed. The scheme of the neural network system model is shown in Fig. 1. Modeling of the system was carried out. It was established that the developed neural network system has high indicators of the quality of functioning.

The scientific novelty of the work consists in the development of a new neural network control system for the two-mass electromechanical system of the bridge crane movement mechanism, which provides high-quality regulation.

Reference

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