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## SYNTHESIS OF AUTOMATIC CONTROL SYSTEMS FOR NPP POWER UNIT IN NORMAL OPERATION MODES

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This paper considers the problems of multicriteria synthesis of intelligent automatic control systems (ACS) for a power unit of a nuclear power plant (NPP) operating as part of an electric power system. Particular attention is paid to the development of mathematical models of the power unit and analysis of parametric tuning of regulators under normal operation conditions.

NPP power unit converts thermal energy generated in the nuclear reactor core into mechanical energy at the turbine shaft and, further, into electrical energy produced by the turbine generator. The key control task is to ensure a balance between energy production and consumption, which is achieved by stabilizing the parameters of technological circuits.

The mismatch between the heat input power and the turbine power consumption leads to deviations of the coolant temperature in the first circuit and the saturated steam pressure in the second circuit. To eliminate these deviations, a reactor power regulator is used, which realizes a control effect depending on the current operating mode of the power unit. Under normal operation conditions, one of the astatic control modes is provided - maintenance of the specified neutron power (“H-mode”) or stabilization of steam pressure before the turbine (“T-mode”).

The aim of the study is to formalize the problems of synthesis of ACS of NPP power unit as a multicriteria optimization problem. A mathematical model of a power unit as a controlled object has been developed. On its basis the systems of automatic control of neutron power and steam pressure using different types of regulators are synthesized. Parametric synthesis is carried out by minimization of improved integral quadratic estimates (IQE) and optimization of direct control quality indicators.

The proposed approach provides the increase of reliability and quality of NPP power unit control system functioning while maintaining stability and required accuracy of regulation in different operating modes.

*Keywords:* automatic control systems, power unit, parametric synthesis, regulator, nuclear power plant.