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METHODS OF SYNTHESIS OF AUTOMATIC CONTROL SYSTEMS OF POWER UNITS

Automatic control systems (ACS) of power units are complex high-coordinate dynamic objects. Designing such systems requires a compromise between control quality and structural complexity. Taking into account the growing requirements to reliability and accuracy of automatic control systems, the actual task is to improve the methods of their synthesis and analysis [1].

The quality of an ACS is traditionally evaluated by the characteristics of transient processes under standard input influences. The most important direct quality indicators (DQI) are overshoot, regulation time and oscillation, which allow us to judge the reliability and speed of the system. Despite their high accuracy, direct indicators are labor-intensive to calculate, which explains the widespread use of indirect indicators - frequency, root-mean-square and integral indicators [2].

Particular attention is paid to the simplest integral quadratic estimator (IQE) as the most widely used one. However, improved IQEs that include error derivatives potentially provide better control, but their application is limited due to computational difficulties.

Among the methods of synthesis of control systems, approaches based on Lyapunov functions, variational, spectral, game and analytical methods are considered. Particular attention is paid to the synthesis of PID controllers as the most applicable in power engineering. It is revealed that existing methods are often focused on indirect quality indicators and do not always provide the necessary control accuracy. Modern tools allow to automate calculation and synthesis, but do not completely solve the problem of PID optimization [3].

The task of developing methods of parametric synthesis of regulators according to direct and improved integral quality indices remains topical. Such methods, with proper formalization and implementation of numerical optimization algorithms, can significantly increase the efficiency of power unit control systems, especially in conditions of their high dynamic complexity and strict requirements to reliability and stability.

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