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## Development of Regulators Synthesis Method for Magnetic Plasma Control System of the T-15 Tokamak

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In the present study a method of developing a magnetic control system of the plasma parameters (position, form, current) of the modernized now tokamak T-15 is described. According to the identification of the electromagnetic system and the plasma column of T-15 linear models are built for obtaining control regulators of the two types: 1) proportional-differential regulator to control of plasma parameters; 2) double-circuit system consisting of a regulator of control of the currents in the poloidal coils and a generator of settings of the currents in the poloidal coils that minimize the variance of the plasma parameters values. For the synthesis of regulators technique of linear-quadratic (LQ) control is used, in which providing of the specified quality of transient processes produced by adjusting the weighting coefficients for each controllable value and for each regulatory impact. A separate control system circuit is provided for the vertical stabilization of the plasma column using fast coil for the horizontal field. Stabilization is possible both using the proportional-differential regulator which provides the desired vertical coordinate, and using the differential damping controller in which the vertical position of the column is being stabilized by the outer circuit of the gaps control. Also a linear model was developed for the stationary phase on the basis of applying increments of currents in the coils of the poloidal system and every element of the vessel with the construction of the response matrix to the plasma parameters from the disturbance. A comparison of the results of calculations performed in various linear models with the T-15 plasma evolution calculations made by a non-linear model based on the DINA code. Identification of linear models and synthesis of controllers performed at different temperatures of the plasma and for different points of a scenario of the discharge (for divertor and limiter configuration of the plasma equilibrium). A technique is developed to switching between the regulators created for different conditions. This makes it possible to carry out calculations of the entire scenario of discharge, including modes of the current ramp up, stationary stage and the current ramp down.

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