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CONTENTS

INVITED TALKS

ALGEBRA

Stability "In the Large" of Movement of Models of Phase Systems on a Finite Interval of Time

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Abstract. In report sufficient stability conditions "in the large" of models of phase systems are obtained.

Consider the general model of phase systems:

$$\frac{d\delta_i}{dt} = s_i, \qquad \frac{ds_i}{dt} = w_i - D_i s_i - f_i(\delta_i) - \psi_i, w_i = c_i^* x_i, \tag{1}$$

$$\frac{dx_i}{dt} = A_i x_i + q_i s_i + b_i u_i, \qquad i = \overline{1,l}, \qquad t \in [t_0, T], \tag{2}$$

where δ_i is angular coordinate; S_i is angular velocity; x_i is n_i- vector of the state regulator; u_i is feedback control. Let $f_i(\delta_i)$ – nonlinearity in the control object, is 2π – continuously differentiable periodic function. In a specific power system the function $\psi_i(\delta_i)$ defines the interaction of the i-th generator with other generators in the system.

The task is to study the stability "in the large" of the system (1), (2).

Theorem. Let the following conditions hold: 1) function $f_i(\delta_i)$ satisfies condition $f_i(\delta_{0i}) = \frac{1}{T_i}\left[P_{ij}\sin(\delta_{i0} + \delta_{j1}) - P_i \sin\delta_{i0}\right], i = \overline{1,l}$; 2) function $P_{ij}(\lambda)d\lambda$ satisfies conditions $P_{ij}(\lambda)d\lambda = P_{ij}(\lambda)$, $P_{ij}(\lambda) = -P_{ij}(-\lambda)$, $P_{ij}(\delta_{ij})\delta_{ij} \geq 0$; 3) constants $\alpha_i, D_i > 0$ such that *a)* $\alpha_i = \frac{K}{D_i}$, $0 < K < \min\{D_1,...,D_l\}$, *б)* $f_i^1(0) \neq \alpha_i D_i^2(1-\alpha_i)$. Then the zero equilibrium T_0 is asymptotically stable in the Lyapunov sense and internal evaluation of the domain of attraction of a singular point T_0 is determined by the area bounded by the surface $V(\delta, s) = T$, where $T = \min_{1 \leq i \leq N} V(T_i)$, if $T_i, i = \overline{1,N}$ are unstable singular points of the system (2).

A concrete example of system "the synchronous generator – the steam turbine" is reviewed.

Keywords. Model, phase systems, stability, control.

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