On the controllability of the multidimensional phase system

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Abstract: We will study the issues of controllability multidimensional phase system. The problem is reduced to a system of nonlinear differential equations, for which we develop a method proposed in [1]. Consider the following model of the phase system, "synchronous generator- steam turbine," described by differential equations of the form

$$\begin{cases} \dfrac{d\delta}{dt} = S, \\ T_j \dfrac{dS}{dt} = P_T - KS - \left[\dfrac{E^2}{z_{11}} sin\alpha_{11} + \dfrac{EU}{z_{12}} \sin(\delta - \alpha_{12})\right], \\ T_P \dfrac{dP_T}{dt} = -P_T + \rho_o P_0 - \dfrac{P_0}{\sigma_0} S + u, \end{cases} \quad (1)$$

where P_T-power steam turbine; T_P-time constant cycle regulation of the steam turbine; ρ_o, P_0-defined constants (ρ_o-start opening the windows spool, P_0-rated power turbines); σ_0-statism Archway (automatic speed control); u - control effects MUT (turbine control mechanism); δ - angle EMF generator; S-slip generator; T_j- constant inertia of the rotating masses; K> 0 - damping coefficient; E-EMF generator design; U-busbar voltage infinite capacity z_{11}-inherent resistance of the generator; z_{12}-mutual impedance between the generator and tires; α_{11}-additional angle own resistance; α_{12}-additional angle relative resistance.

For the system of regulation of the steam turbine, we give the following parameters: $\rho_o = 0.994, T_P = 251.2, P_0 = 10420, \sigma_0 = 0.06$.

Keywords: electric power system, nonlinear system, phase system, controllability, synchronous generator.

References:

[1] S.A. Aysagaliyev, Theory of phase systems Kazakh University, Almaty, 2005.