On global asymptotic stability of difference, differential and integro-differential phase equations

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Abstract

In the paper certain general aspects of asymptotic behavior of nonlinear mathematical models for various phase synchronization systems are investigated. Three kinds of many-dimensional and infinite-dimensional systems with periodic nonlinear functions are considered. They are systems of difference and differential equations with stable linear part and systems of Volterra integro-differential equations with exponentially decreasing kernels. The systems under consideration have denumerable sets of equilibria which may be both Lyapunov stable and Lyapunov unstable.

In the paper several theorems, containing many-parametric frequency-domain inequalities, which guarantee that every solution of phase system tends to a certain equilibrium, are demonstrated. The frequency-domain inequalities are also used to establish uniform estimates for the deviation of the solution from its initial value. The proofs are based on periodic Lyapunov functions and Popov functionals and Yakubovich-Kalman frequency theorem.

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