ESTIMATIONS OF STABILITY REGIONS AND TRANSIENT BEHAVIOR OF INTERCONNECTED SYSTEMS

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The object of this paper is to study the behavior of composite systems in terms of their subsystems and interconnections. The approach developed here is general enough to include time-varying nonlinear high order systems composed of locally stable, globally stable and unstable subsystems. The properties of transient behavior and stability of the subsystems are described by convenient Lyapunov functions. In terms of these Lyapunov functions and the boundedness properties of the interconnections, a linear comparison system of order equal to the number of subsystems is established. Its study furnishes conditions concerning the stability and the transient behavior of the composite system. The simple algebraic conditions developed here are derived by a direct study of the comparison system without using new Lyapunov functions.

This paper is devided into two parts. In part I estimates are given of the region of asymptotic stability for the composite system. In part II the transient behavior is examined and conditions are developed in order to obtain a desired exponential rate of convergence for every subsystem.