

Hierarchical Lyapunov Functions for Stability Analysis of Discrete-Time Systems with Applications to the Neural Networks

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Received: October 10, 2003; Revised: March 26, 2004

Abstract: In the paper the application of hierarchical Lyapunov functions is proposed for qualitative analysis of solutions of discrete-time system. General results of analysis of quasi-linear discrete system are applied to the analysis of robust stability of large-scale neural system in the case of unperturbed and perturbed equilibrium state. The obtained results are compared with those obtained via the application of vector Lyapunov function in this problem. It is shown that the application of hierarchical Lyapunov function allows us to extend the boundaries of the parameter values of the neural network for which the exponential stability of its solutions takes place. The examples illustrating the efficiency of the proposed approach are given.

Keywords: *Discrete-time system; large-scale system; neural system; exponential stability; hierarchical Lyapunov function.*

Mathematics Subject Classification (2000): 39A11, 93C55, 93D30, 92B20.