Robustness Analysis of a Class of Discrete-Time Systems with Applications to Neural Networks

Zhaoshu Feng and A.N. Michel*

Department of Electrical Engineering, University of Notre Dame, Notre Dame, IN 46556, USA

Received: January 11, 2000; Revised: December 30, 2002

Abstract: In this paper we study the robust stability properties of a large class of nonlinear discrete-time systems by addressing the following question: given a nonlinear discrete-time system with specified exponentially stable equilibria, under what conditions will a perturbed model of the discrete-time system possess exponentially stable equilibria that are close (in distance) to the exponentially stable equilibria of the unperturbed discrete-time system? In arriving at our results, we establish robust stability results for the perturbed discrete-time systems considered herein. We apply the above results in the robustness analysis of a large class of discrete-time recurrent neural networks.

Keywords: *Discrete-time systems; robust stability; neural networks.*

Mathematics Subject Classification (2000): 34C35, 34D05, 34D20, 34D45, 34H05, 54H20, 93C10, 93C15, 93C50, 93C60, 93D05, 93D20, 93D30.