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New Conditions for Global Stability of Neutral-Type Delayed Cohen-Grossberg Neural Networks

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Abstract

This paper carries out a theoretical investigation of the class of neutral-type delayed Cohen-Grossberg neural networks by using the Lyapunov stability theory. By employing a suitable Lyapunov functional candidate, we derive some new delay independent sufficient conditions for the global asymptotic stability of the equilibrium point for the neutral-type Cohen-Grossberg neural networks with time delays. The obtained stability conditions can be completely characterized by the networks parameters of the neutral systems under consideration. Therefore, it is easy to verify the applicability of our results by simply using some algebraic manipulations of the conditions. Some numerical examples are also given to show the effectiveness of the derived analytical results. A detailed comparison between our proposed results and recently reported corresponding stability results is also made, revealing that the conditions given in this paper establish a new set of stability criteria for Neutral-Type Cohen-Grossberg Neural Networks.

Keywords : Lyapunov Stability Theorems, Neutral Systems, Neural Networks, Matrix Theory.

1 Introduction

Since the introduction of dynamical neural networks in 1980s, many researches have focused on the dynamical analyzes of various classes of neural networks such as Cohen-Grossberg neural networks, Hopfield-type neural networks, cellular neural networks and bidirectional associative memory neural networks and studied the equilibrium and stability properties of these classes of neural networks. They have also been successfully applied to solving different types of practical engineering problems including, pattern recognition, image processing, signal processing, control and optimization (for more details, see [1]-[5]. In most of the applications of neural networks to such engineering problems, the designed neural network is required to have the stable dynamics as the processed information is of the form of stable states. As an instance, when a neural network is electronically implement by using electronic components, the finite switching speed of amplifiers will cause some time delays during the communication between neurons. The existence of time delays may lead to complex nonlinear dynamical behaviors such as instability, bifurcations, periodic solutions and chaos, which can turn the desired dynamics of neural networks into some undesired dynamical behaviors. Therefore, in recent years, the analysis of dynamical characteristics of neural