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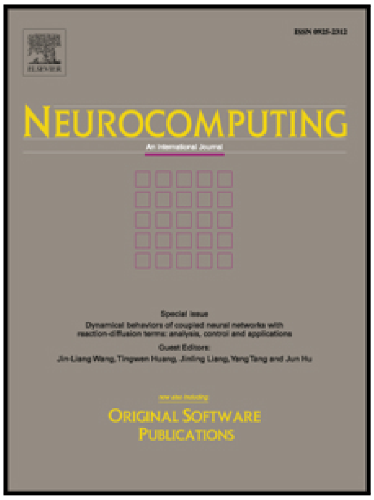

Non-fragile chaotic synchronization for discontinuous neural networks with time-varying delays and random feedback gain uncertainties

Xiao Peng, Huaiqin Wu, Ka Song, Jiaxin Shi

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Non-fragile chaotic synchronization for discontinuous neural networks with time-varying delays and random feedback gain uncertainties

Xiao Peng, Huaiqin Wu*, Ka Song, Jiaxin Shi

School of Science, Yanshan University, Qinhuangdao 066001, China

Abstract

This paper is concerned with the non-fragile synchronization issue for neural networks with discontinuous activation functions, time-varying delays and random feedback gain uncertainties, where the randomly occurring phenomena are modeled by stochastic variables satisfying the Bernoulli distribution. The appropriate non-fragile controllers are designed to ensure that the global synchronization can be achieved easily. Under the extended Filippov differential inclusion framework, by applying non-smooth analysis theory with a generalized Lyapunov-Krasovskii functional with multiple integral terms and Wirtinger-based multiple integral inequality analysis technique, the global asymptotical stochastic stability of the synchronization error dynamical system is analytically proved, and the non-fragile synchronization conditions are addressed in terms of linear matrix inequalities (LMIs). Finally, two numerical examples are given to demonstrate the feasibility of the proposed non-fragile controller and the validity of the theoretical results.

Keywords: Neural networks; Discontinuous activation function; Non-fragile synchronization; Wiritinger-based multiple integral inequality; Lyapunov-Krasovskii functional

1. Introduction

In the past decades, neural networks (NNs) have been found extensive applications in optimization, classification, solving nonlinear algebraic equations, signal and image processing, pattern recognition, automatic control, associative memories, and so on [1-5]. Such applications heavily depend on the dynamic behavior of networks, such as stability, periodic oscillation, almost periodic oscillation and chaos, et al..

Recently, the dynamic behavior of NNs with discontinuous(or non-Lipschitz) neuron activations has received more attention from many scholars. In [6], authors firstly considered the global convergence of NNs with discontinuous activation functions. Authors in [7] investigated the global exponential stability and global convergence in finite time for delayed NNs with infinite gain. Subsequently, many efforts have been paid for analyzing variety of the dynamic behavior of discontinuous neural networks, and a lot of works, which is concerned with almost periodic solution, multiple equilibria and multistability, periodicity and multi-periodicity and robust dissipativity, et al., have reported, see [8-18], and references therein.

After the chaos synchronization firstly put forward in 1990 in [19], more and more researchers pay enough attention to studying synchronization and control for autonomous chaotic systems. The increasing interest in researching the chaotic synchronization stems from its potential applications in bioengineering [20], secure communication [21], and cryptography [22]. With the discovery of more and more non-autonomous chaotic systems in engineering sciences and physics, various control techniques for controlling and synchronizing non-autonomous chaotic systems have been developed, such as adaptive projective synchronization control [23-25], lag synchronization control [26], generalized synchronization control [27], phase synchronization control [28], finite-time synchronization control [29], non-fragile synchronization control [40,41] and so on. In [31], authors studied the dissipativity and quasi-synchronization for discontinuous NNs with and without parameter mismatches. In [32], synchronization issue about discontinuous NNs were addressed via approximation. Authors in [33,34,37] es-

*Corresponding author

Email address: huaiqinwu@ysu.edu.cn (Huaiqin Wu)

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