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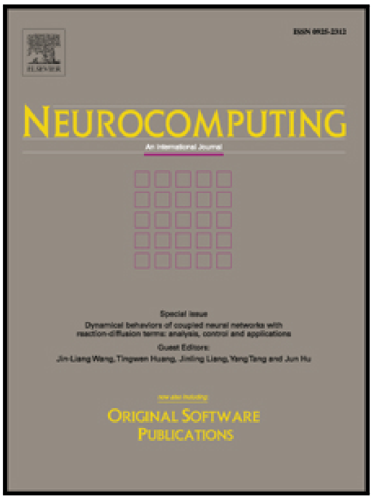

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Finite-time synchronization of fractional-order memristive recurrent neural networks with discontinuous activation functions☆

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Abstract

This paper is concerned with the finite-time synchronization for a class of drive-response fractional-order memristive recurrent neural networks with discontinuous activation functions. By using the theories of fractional-order differential inclusions and set-valued map, the finite-time synchronization problem for a class of drive-response fractional-order memristive recurrent neural networks with discontinuous activation functions is formulated under the framework of Filippov solution. Then, two novel state feedback controllers are designed according to state feedback control technique. In particular, based on the fractional Lyapunov stability theory, the finite-time stability theory and Young inequality, some novel algebraic synchronization criteria are obtained to ensure the finite-time synchronization of a class of drive-response fractional-order memristive recurrent neural networks with discontinuous activation functions. Moreover, we give the estimation of the upper bound of the settling time for synchronization. Finally, a simulation example is given to show the effectiveness of our theoretical results.

Keywords: Memristive recurrent neural networks, Finite-time synchronization, Discontinuous activation functions, State feedback control.

1. INTRODUCTION

In the past few years, artificial neural networks have been received a great deal of attentions [1–4], because they have many practical applications in a variety of fields such as machine learning [5], pattern recognition [6], image processing [7] and associate memory [8]. As an important branch of mathematical analyses [9], fractional derivative has been introduced to artificial neural networks due to its infinite memory and more degrees of freedom [10]. It is well known that fractional-order neural networks have many competitive virtues over integer-order artificial neural networks [11]. Subsequently, fractional-order neural networks have attracted lots of researchers to study their dynamical behaviors, and researchers have obtained a large number of excellent results on their dynamical behaviors [12–14]. For instance, in [12], by adopting Krasnoselskii fixed point theorem and the contraction mapping principle, uniform stability problem for a general class of fractional-order neural networks was investigated. In [13], as an extension of real-valued recurrent neural networks, existence and uniform stability analysis for fractional-order complex-valued neural networks with delays were studied. In [14], the global stability analysis for fractional-order Hopfield neural networks with delays was studied, and a stability theorem and a comparison theorem were obtained.

On the other hand, in artificial neural networks, synapse is essential element because it is responsible for information storage and computation. Synapses need to respond in response to the post-synaptic and

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