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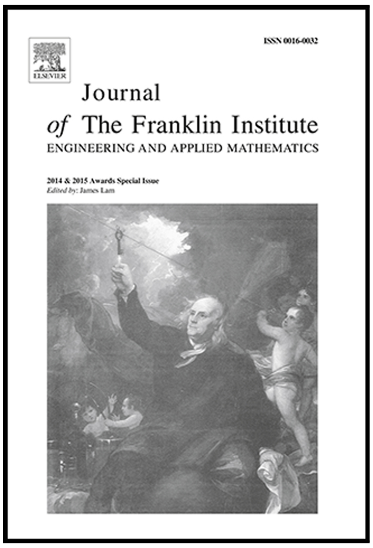

General decay synchronization of memristor-based Cohen-Grossberg neural networks with mixed time-delays and discontinuous activations

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General decay synchronization of memristor-based Cohen-Grossberg neural networks with mixed time-delays and discontinuous activations

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Abstract: This paper investigates the general decay synchronization (GDS) of memristor-based Cohen-Grossberg neural networks (MCGNNs) with discontinuous neuron activation functions and mixed time-delays. Based on the concept of Filippov solution and theory of differential inclusion, introducing suitable Lyapunov-Krasovskii functionals and employing useful inequality techniques, some novel criteria ensuring the GDS of considered Cohen-Grossberg neural networks are established via two types of nonlinear controls. In addition, the feasibility of the obtained theoretical results is validated via two numerical examples and their simulations. The polynomial synchronization, asymptotical synchronization, and exponential synchronization can be seen the special cases of the GDS. To the authors' knowledge, the results established in the paper are the only available results on the synchronization of neural networks, connecting the three main characteristics, i.e., memristor, discontinuous activation functions and mixed time-delays.

Key words: Memristor, Cohen-Grossberg neural network, General decay synchronization, Discontinuous activation, Mixed delay

1 Introduction

In the past few years, memristor-based neural networks (MNNs) have been extensively investigated based on the belief that it will profoundly improve human's capability on the neural processing using memory devices, which is presumed to be an essential step towards replicate complex learning via artificial neural networks [1]. The main difference between MNNs and conventional neural networks is that the strengths of synapses among the neurons are modeled by memristors in MNNs, while the resistors are employed in the conventional neural networks to model the strengths of synapses among neurons. Unlike resistors, the conductance of memristors can response to the changes of applied current or voltage just like a biological synapse [2], and they possess very nice device characteristics including nonvolatility, multiple memory states, and nanometer geometries that can be shrunk to the ultimate physical dimensions [3–6]. These superior features of memristors enable them to be successfully applied in nonvolatile memory [7], artificial neural networks [2, 8–13], composite circuits [14, 15], and so on.

When we investigate the dynamical behaviours of neural networks, synchronization is one of the major concerns in which the primary attention should be given. This is rooted in the fact that the synchronization is unique in nature and can play an extremely vital

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