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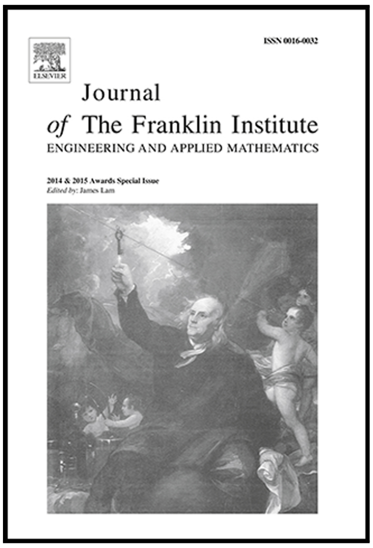


# Stop and Go Adaptive Strategy for Synchronization of Delayed Memristive Recurrent Neural Networks with Unknown Synaptic Weights

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# Stop and Go Adaptive Strategy for Synchronization of Delayed Memristive Recurrent Neural Networks with Unknown Synaptic Weights

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**Abstract**

Although the drive-response synchronization problem of memristive recurrent neural networks (MRNNs) has been widely investigated, all the existing results are based on the assumption that the parameters of the drive system are known in prior, which are difficult to implement in real-life applications. In the present paper, a Stop and Go adaptive strategy is proposed to investigate the synchronization control of chaotic delayed MRNNs with unknown memristive synaptic weights. Firstly, by defining a series of measurable logical switching signals, a switched response system is constructed. Subsequently, by utilizing the logical switching signals, several suitable parameter update laws are proposed, then some different adaptive controllers are devised to guarantee the synchronization of unknown MRNNs. Since the parameter update laws are weighted by the logical switching signals, they will work or stop automatically with the switch of the unknown weights of drive system. Finally, two numerical examples with their computer simulations are provided to illustrate the effectiveness of the proposed adaptive synchronization schemes.

*Keywords:* Memristive recurrent neural networks, Stop and Go strategy, adaptive synchronization control, unknown memristive synaptic weights, logical switching signal

## 1. Introduction

The concept of memristor was originally postulated by Chua in 1971 [1]. Until 2008, HP Lab firstly unveiled a $TiO_2$ nanoscale device that realized memristive characteristics [2]. It is interesting to note that the value of memristor (i.e., memristance) depends on how signals are applied over time rather than the instantaneous inputs alone. Hence memristors exhibit memory effect. For example, when the voltage is turned off, the memristor remembers its most recent value until next time when it is turned on. The memristor works are close to biological synapses, with the memristance varying with experience, or with the current flowing through it over time. The behavior of memristor can be used in artificial neural networks, such as pattern recognition or signal processing from sensor arrays, in a way that mimics the human brain [3]. In [4], a simplified mathematical model was put forward to characterize the pinched hysteretic feature of memristor, and memristive recurrent neural networks (MRNNs) model were then primarily introduced. Based on the previous work in [4], an ocean of investigations on the qualitative analysis and control of MRNNs followed (such as [5]-[9]). MRNNs are developed by replacing the resistors in traditional recurrent neural networks with the memristors. Compared with traditional recurrent neural networks [10, 11], MRNNs have many evident advantages. For example, chaotic MRNNs are safer for secure communications [12, 13], MRNNs possess more memory storage capacity [14], the computation power and information capacity can be substantially enhanced by using MRNNs [15]. These advantages imply that MRNNs have promising prospect in applications.

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