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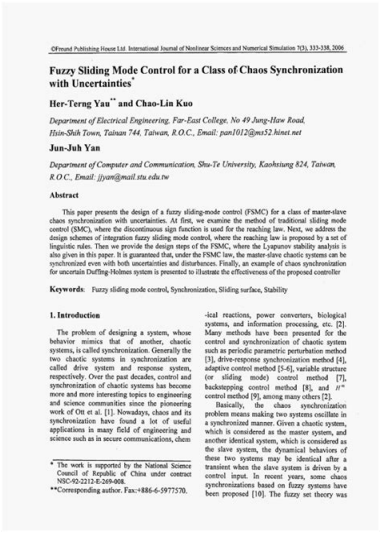

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Fuzzy Sliding Mode Control for a Class of Chaos Synchronization with Uncertainties*

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Abstract

This paper presents the design of a fuzzy sliding-mode control (FSMC) for a class of master-slave chaos synchronization with uncertainties. At first, we examine the method of traditional sliding mode control (SMC), where the discontinuous sign function is used for the reaching law. Next, we address the design schemes of integration fuzzy sliding mode control, where the reaching law is proposed by a set of linguistic rules. Then we provide the design steps of the FSMC, where the Lyapunov stability analysis is also given in this paper. It is guaranteed that, under the FSMC law, the master-slave chaotic systems can be synchronized even with both uncertainties and disturbances. Finally, an example of chaos synchronization for uncertain Duffing-Holmes system is presented to illustrate the effectiveness of the proposed controller

Keywords: Fuzzy sliding mode control, Synchronization, Sliding surface, Stability

1. Introduction

The problem of designing a system, whose behavior mimics that of another, chaotic systems, is called synchronization. Generally the two chaotic systems in synchronization are called drive system and response system, respectively. Over the past decades, control and synchronization of chaotic systems has become more and more interesting topics to engineering and science communities since the pioneering work of Ott et al. [1]. Nowadays, chaos and its synchronization have found a lot of useful applications in many field of engineering and science such as in secure communications, chemical reactions, power converters, biological systems, and information processing, etc. [2]. Many methods have been presented for the control and synchronization of chaotic system such as periodic parametric perturbation method [3], drive-response synchronization method [4], adaptive control method [5-6], variable structure (or sliding mode) control method [7], backstepping control method [8], and H^{∞} control method [9], among many others [2].

Basically, the chaos synchronization problem means making two systems oscillate in a synchronized manner. Given a chaotic system, which is considered as the master system, and another identical system, which is considered as the slave system, the dynamical behaviors of these two systems may be identical after a transient when the slave system is driven by a control input. In recent years, some chaos synchronizations based on fuzzy systems have been proposed [10]. The fuzzy set theory was

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