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ADAPTIVE SYNCHRONIZATION OF A CLASS OF CHAOTIC SYSTEMS SUBJECT TO UNCERTAINTIES AND TIME DELAY

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Abstract. In this paper, we aim to study the robust global synchronization problem for a class of chaotic systems subject to time delay and uncertainties. The effects of time-delay arise from the physical characteristics of coupled channel, while the system uncertainties arise due to unknown but bounded external disturbances and parametric perturbations. Selecting the observer controller and adaptation mechanism appropriately, master-slave chaotic synchronization can be guaranteed by use of the Lyapunov approach. Finally, the Chua's circuit is used as an illustrative example, where simulation results are given to demonstrate the effectiveness of the proposed scheme.

Keywords. Chaotic systems, adaptive synchronization, robust adaptive observers, channel time-delay, Chua's circuit.

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1 Introduction

Chaos synchronization [1,2] has attracted much attention during the past years because of its role in our understanding of the basic features of man-made and natural systems; see, for example, recent books and reviews [3-5]. Various types of chaos synchrony, whose description may require different theoretical frameworks, were found in natural systems and specified. These types of synchrony include identical synchronization, generalized synchronization [6,7], and phase synchronization [8].

Generally speaking, research on chaos synchronization may be grouped around two problems. The first one, which we call analysis problem, consists of understanding and/or giving theoretical description of synchronization phenomena. In the second problem, so-called synthesis problem, one concerns on finding (or designing) a synchronization control signal, such that two chaotic systems exhibit various type of synchronous behaviors. Some authors proposed a unified definition of synchronization, which covers for all types of synchronization between deterministic finite dimensional systems [9-11].

The typical configuration of chaotic synchronization consists of master and slave systems. The master system drives the slave system via a scalar