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CHAOS SYNCHRONIZATION USING IMPULSIVE DRIVING AND APPLICATIONS TO SECURE COMMUNICATIONS

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Abstract. This paper investigates chaos synchronization using impulsive driving. A stability result is established first for a class of impulsive differential equations. This result is then used to obtain synchronization criterion for chaotic systems. As an application, a chaotic communication scheme is developed. Simulation results show that our scheme has advantages over some other schemes found in the literature.

Keywords. Chaos, synchronization, impulsive differential equations, impulsive driving, secure communication.

1 Introduction

Since Pecora and Carrol [8] proposed their well-known self synchronization method to synchronize two chaotic systems, several variations of the method have been successfully established such as synchronization by cascaded drive-response [1], synchronization by partial replacement [5], synchronzation by unidirectional coupling [8], and synchronization by sporadic driving [9]. Each method has its own constraint in applications. For example, self-synchronization requires that the driven subreponse system is asymptotically stable and synchronization by sporadic driving requires that the undriven subsystem is asymptotically stable. To decompose a practical system into subsystems which satisfy such requirement is not an easy problem in some situations. In addition, it is impossible to recover the original information signal exactly from the chaotic masked signal if self-synchronization method is used in a chaotic masking communication scheme. This is because the driving signal is acting as perturbation to the driven subreponse system, and chaotic systems are inherent sensitive to perturbations. Synchronization by impulsive driving has some advantages over the method of Pecora and Carrol and its variations in the sense that it is not necessary to decompose a chaotic system into subsystems and only a small portion of channel resource is needed to transmit the driving impulses. Impulsive synchronization of Lorenz systems was reported in [10].