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ROBUST IMPULSIVE SYNCHRONIZATION FOR UNCERTAIN UNIFIED CHAOTIC SYSTEMS WITH CHANNEL TIME-DELAY

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Abstract. For the uncertain unified chaotic systems with channel time-delay, a robust impulsive synchronization scheme is proposed. Based on the theory of impulsive differential equations, a new and less conservative sufficient condition is established in order to guarantee the robust synchronization of the chaotic systems. In particular, a simple and practical condition is derived by choosing equal impulsive distances and control gains. Simulation results finally demonstrate the effectiveness of the method.

Keywords. Impulsive control, synchronization, unified chaotic systems, uncertain, channel time-delay.

1 Introduction

During the last two decades, chaos synchronization has been a focus topic of intensive research [1]. After the pioneer work of Pecora and Carroll [8], many different methods are applied theoretically and experimentally to synchronize the chaotic systems, such as linear and nonlinear feedback control [2,5], variable structure control [10], adaptive control [11], impulsive control [3,4], active control [9], etc. Among these methods, impulsive control may give an efficient method to deal with the dynamical systems which cannot be controlled by continuous control. Additionally, in synchronization process, the response system receives the information from the drive system only at the discrete time instants. This drastically reduces the amount of synchronization information transmitted from the drive system to the response system which makes this method more efficient and useful in a great number of real-life applications.

Strictly speaking, in the practical environment with signal propagation delays, it is not reasonable to require the response system to synchronize the drive system at exactly the same time. For this reason, Ref.[6] re-defined the chaotic synchronization in such a way that the state of the drive system at time $t-\eta$ asymptotically synchronizes with the response system at time t, namely

$$\lim_{t\to\infty} \|\mathbf{x}(t-\eta) - \tilde{\mathbf{x}}(t)\| = 0,$$