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CHAOS SYNCHRONIZATION FROM AN INVARIANT MANIFOLD APPROACH

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Abstract. In this paper, a chaos synchronization method via an invariant manifold approach is proposed. The essence of the method is that the error dynamics between the transmitter and receiver are pushed and forced to stay in the pre-selected invariant manifolds in which the error will converge to zero asymptotically. The well known input-output linearization method is used to discuss the design. Simulation results on the Lorenz system are presented to shown the effectiveness of the method.

Keywords. Chaos synchronization, invariant manifold, feedback, linearization

1 Introduction

Chaotic systems have been studied and are known to exhibit complex dynamical behaviors in the past two decades. The interest in chaotic systems lies mostly in their complex, unpredictable behavior, extreme sensitivity to both initial conditions and parameter variations, and their rich broad-spectrum and noise-like signals. Many theories of chaos control and chaos synchronization have been developed.

Although the first paper on synchronization motions of chaos systems was published in 1983 [4], it is Pecora and Carroll's work [10] that has provoked intensive research on chaotic synchronization and has opened a way to envisage engineering applications of chaos [1]. In their work, chaos synchronization was studied in the situation where a state variable (or variables) of a chaotic system is used as an input to drive a subsystem that is a replica of part of the original system (called drive-response, or transmitter-receiver, or master-slave synchronization formalisms). They find that the replica subsystem sometimes synchronizes to the chaotic evolution of the original system. The condition for this synchronization to occur depends on the original chaotic system and the choice of the part of the original system that is used