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Adaptive Sliding Mode Control Synchronization of a Novel, Highly Chaotic 3-D System with Two Exponential Nonlinearities

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Abstract: In this paper, a new 3D chaotic system with three nonlinearities is introduced. Basic dynamical properties of this new chaotic system are studied such as equilibrium points and their stability, dissipativity and Lyapunov exponent, Lyapunov exponent spectrum, Kaplan-Yorke dimension. Also, an adaptive integral sliding mode control scheme is proposed for synchronization of the new chaotic system with unknown system parameters based on the Lyapunov stability theory and adaptive control theory of this new chaotic system with unknown system parameters. Finally, numerical simulations are presented to show the effectiveness of the proposed chaos synchronization scheme using Matlab.

Keywords: *chaotic system; strange attractor; Lyapunov exponent; Lyapunov stability theory; adaptive control; synchronization.*

Mathematics Subject Classification (2010): 37B55, 34C28, 34D08, 37B25, 37D45, 93C40, 93D05.

1 Introduction

Chaos as an important nonlinear phenomenon has been studied in mathematics, engineering and in many other disciplines. Synchronization of chaotic systems has become an active research area because of its potential applications in different industrial areas [1, 2, 3]. For the first time chaotic synchronization was illustrated by Fujiska and Yamada [2] in 1983, then, Pecora and Carroll [3] in 1990, reported a new and very effective method for the synchronization of two chaotic systems with different initial conditions. The control

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