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A Novel Fractional-Order Chaotic System and Its Synchronization via Adaptive Control Method

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Abstract: In this paper, the synchronization of a new fractional-order chaotic system via the adaptive control method is introduced. Firstly, the novel fractional-order system is presented and its dynamics is investigated throughout the Lyapunov exponents spectrum. Secondly, based on the stability theory of fractional-order systems, synchronization of the fractional-order system with fully uncertain parameters is realized by designing appropriate adaptive controllers and estimation laws. Finally, numerical simulations are implemented to demonstrate the effectiveness and flexibility of the synchronization controllers and the estimation laws for the unknown parameters.

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

Mathematics Subject Classification (2010): 34D08, 34C28, 37B55, 37B25, 37D45, 70K20, 93D05, 93D21

1 Introduction

Fractional chaotic dynamical systems are non-linear systems that allow sensitivity to initial conditions, those chaotic systems are widely used in several fields such as physics, chemistry, biology, economics, especially in secure communication and cryptography[1-2].

In 1990, Pecora and Carol [3] introduced for the first time a method of synchronization of two integer-order chaotic systems. After that, many research papers have addressed synchronization between integer-integer order chaotic systems [4-6]. Recently,

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