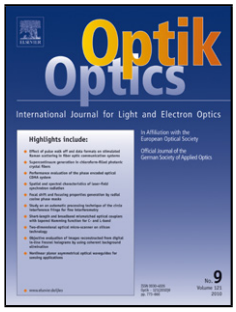

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The exponential synchronization of a class of fractional-order chaotic systems with discontinuous input

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Abstract

This paper investigates the exponential synchronization of a class of fractional-order chaotic systems. The response system is controlled by input which may be either discontinuous or continuous variable. Moreover, the input is assumed to be affected by external disturbance. Based on the Mittag-Leffler function, sufficient conditions for achieving exponential synchronization of fractional-order chaotic systems have been derived. Numerical examples are presented by taking the fractional-order chaotic economical system as an example to verify and demonstrate the effectivenessof the proposed schemes.

Keywords: Exponential synchronization; Discontinuous input; Fractional-order chaotic system

1. Introduction

Chaos synchronization is a common and widespread phenomenon in many science and engineering fields [1]. Since Pecora and Carroll [2] first introduced the master-slave concept for achieving the synchronization between two identical chaotic systems, chaos synchronization has received considerable attentions due to its potential applications in secure communication, biology, economics, signal generator design, and so on. Now, a variety types of chaos synchronization have been proposed, such as complete synchronization [2], phase synchronization [3], anti-synchronization [4], lag synchronization [5], generalized synchronization [6], projective synchronization [7], combination synchronization [8, 9], etc. Many different control methods for chaos synchronization have been developed, including the adaptive control method [10], impulsive approach [11], back-stepping technique [12], sliding control technique [13], sampled-data control scheme [14], and so on.

Recently, research on synchronization of fractional-order chaotic has attracted increasing attention due to its potential application in secure communication and control processing. In [15] the function projective synchronization between two entirely different fractional-order chaotic systems with uncertain parameters was studied by using an adaptive controller. Based on fractional-order stability theory, Authors of [16] proposed a novel method to achieve robust modified projective synchronization of twouncertain fractional-order chaotic systems with external disturbance. Hyperchaos control and adaptive synchronization with uncertain parameter for fractional-order Mathieu-van der Pol systems was studied in [17]. Xue et al. [18] designed a nonlinear feedback controller to synchronize two identical fractional-order generalized augmented L$\ddot{u}$ system. Based on sliding mode control, paper [19] investigated the synchronization of fractional order uncertain chaotic systems with input nonlinearity. Paper [20] considered the exponential synchronization of fractional-order chaotic systems via a non-fragile controller. Based on the Lyapunov stability theory and linear matrix inequalities approach a criterion for α-exponential stability of an error system was proposed.

It is easy to see that the aforementioned synchronization methods are valid only for the continuous controller. As it is well known that the transmission signals may be