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Control, Stabilization and Synchronization of Fractional-Order Jerk System

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Abstract: In this work we study the fractional-order jerk system stability by using the fractional Routh-Hurwitz conditions. These conditions have also been used to control the chaos of the proposed systems towards their equilibrium. It has been shown that the fractional-order systems are controlled at their equilibrium point unlike those of fractional order. The synchronization between two different coupled fractional systems is also achieved via the auxiliary system approach. The numerical simulation coincides with the theoretical analysis.

Keywords: *chaos; chaotic fractional-order system; Routh-Hurwitz criteria; chaos control; chaos synchronization.*

Mathematics Subject Classification (2010): 34C23, 34H10, 34H15, 34A34, 34D06, 37N35, 37C75, 37N30.

1 Introduction

Fractional calculus is a topic more than 300 years old. The idea of fractional calculus has been known since the regular calculus, with the first reference probably being associated with Leibniz and L'Hospital in 1695. Its applications to physics and engineering are just a recent focus of interest. It was found that many systems in interdisciplinary fields can be elegantly described with the help of fractional derivatives. In 1996, Hans Gottlieb thought,'What is the simplest jerk equation that gives chaos ?', by which he meant an equation of the form

$$\dddot{x} = f(\ddot{x}, \dot{x}, x).$$

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