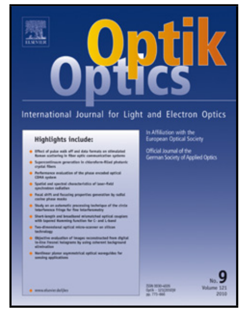
Accepted Manuscript



Title: Suppressing chaos for a class of fractional-order chaotic systems by adaptive integer-order and fractional-order feedback control

Author: Ruihong Li Wei Li

PII: S0030-4026(15)00576-8
DOI: http://dx.doi.org/doi:10.1016/j.ijleo.2015.07.024
Reference: IJLEO 55739

To appear in:

Received date: 4-6-2014
Accepted date: 7-7-2015

Please cite this article as: R. Li, W. Li, Suppressing chaos for a class of fractional-order chaotic systems by adaptive integer-order and fractional-order feedback control, *Optik - International Journal for Light and Electron Optics* (2015), http://dx.doi.org/10.1016/j.ijleo.2015.07.024

Suppressing chaos for a class of fractional-order chaotic systems by adaptive integer-order and fractional-order feedback control

Ruihong Li *, Wei Li

School of Mathematics and Statistics, Xidian University, Xi'an 710071, PR China

Abstract. This paper is devoted to studying how to more effectively suppress chaos for a class of fractional-order nonlinear systems. By means of adaptive control theory for integer-order nonlinear system, we propose two simple and novel adaptive feedback methods to control chaos. Rigorous theoretical proof is provided based on some essential properties of fractional calculus and Barbalat's Lyapunov-like stability theorem. It is discovered that both fractional-order feedback controller and integer-order one can guide chaotic trajectories to the unstable equilibrium point. To display the feasibility and validity of presented methods, some typical fractional-order chaotic systems have been chosen as numerical illustration. Furthermore, by comparing two different control techniques, one can find the fractional-order feedback control algorithm is more stable and more flexible.

Keywords: Fractional-order chaotic system; Integer-order feedback; Fractional-order feedback; Suppress chaos; Barbalat's lemma

1. Introduction

Fractional calculus is a mathematical subject with more than 300 years old history, but its application in physics and engineering has just started [1-3]. One possible explanation for such unpopularity is that there are many different definitions of fractional derivative, another one is fractional derivative has no evident geometrical interpretation due to its non-local property. However, over the past decade, a growing body of research suggests that some practical systems could display fractional order dynamics, such as viscoelasticity [4], dielectric polarization [5], electrode-electrolyte

* Corresponding author.

E-mail address: llylrh8077@126.com (R.-h. Li)