Control of a Novel Class of Uncertain Fractional-Order Hyperchaotic Systems with External Disturbances via Sliding Mode Controller

B. Labed [1,2*], S. Kaouache [1,2] and M. S. Abdelouahab [2]

[1] *Departement of Mathematics. University of Mentouri Brothers, Constantine 25017, Algeria*
[2] *Laboratory of Mathematics and their interactions, Abdelhafid Boussouf University Center, Mila 43000, Algeria*

Abstract: In this paper, a novel class of fractional-order hyperchaotic systems is proposed. In order to control hyperchaos in these systems, an appropriate sliding mode controller is also designed. Based on the Lyapunov stability theory, the control scheme guarantes the asymptotic stability of the fractional-order hyperchaotic systems in the presence of uncertainty and external disturbance. Simulation results of control design of fractional-order Liu and Lorenz hyperchaotic systems are presented to show the effectiveness of the proposed scheme and stabilization of the systems on the sliding surface.

Keywords: *hyperchaotic systems; fractional-order system; sliding mode control; Lyapunov stability.*

Mathematics Subject Classification (2010): 34A34, 37B25, 37B55, 93C55, 37C25, 93D05.

1 Introduction

The concepts of derivation and fractional integration are often associated with the names of Riemann and Liouville, while the question about the generalization of the notion of fractional-order derivative is older. Indeed, the history of fractional calculus goes back more than three centuries. Recently, fractional calculus has attracted the increasing attention of physicists as well as engineers in several fields of engineering science [1].

---

* Corresponding author: `mailto:labed.math@yahoo.fr`