Journal of Vibration Testing and System Dynamics 9(4) (2025) 309-320

Journal of Vibration Testing and System Dynamics

Journal homepage: https://lhscientificpublishing.com/Journals/JVTSD-Default.aspx

Controlling Chaos with Analysis of Fractional Chaotic System Based on Memcapacitor and Meminductor

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Submission Info

Communicated by Albert C. J. Luo
Received 11 June 2024
Accepted 13 November 2024
Available online 1 October 2025

Keywords

Chaos control
Fractional order
Lyapunov diagrams
Bifurcation diagrams
Stagnation points

Abstract

The paper acknowledges the fractional five dimensional chaotic system based on memcapacitor and meminductor. The system is thoroughly analyzed by using dynamical tools of phase portraits, bifurcation diagrams, Lyapunov values, solution, stagnation points. Considering uncertainties and disturbances chaos in the system is controlled and uncertainties with disturbances are estimated using adaptive sliding mode technique.

1 Introduction

In contrast to other systems which are limited to a specific range of time and place chaotic systems are ubiquitous in nature. The study of chaotic systems [1, 2] has advanced significantly in recent years as a result of the quick development of mathematical sciences, physical sciences and instrument sciences. L.O.Chua originally merged chaos theory [3,4] and nonlinear circuits in his 1984 proposal of the Chua's circuit. Numerous new chaotic systems have been proposed by various researchers as a result of the in depth study of chaotic theory [5–7] and the analysis [8–10] of the dynamic behavior [11, 12] of chaotic systems has gradually improved. The study of chaotic systems extends beyond integer-order systems to include fractional-order [13–15] chaotic systems. The focus of chaos research continues to be the construction of nonlinear circuits to explore the dynamics of chaotic systems and their synchronization [16, 17]. The first chaotic system was discoverd in 1960 by Lorenz. This led to the scientific community across the globe to tame chaos. Synchronization of chaotic systems and chaos control got popularity in taming chaos using different control techniques such as active control, adaptive

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ISSN 2475-4811, eISSN 2475-482X/$-see front materials
DOI:10.5890/JVTSD.2025.12.001