



Some New 4D Fractional-Order Hyperchaotic Rabinovich Systems: Dynamical Analysis and Control

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Received: March 21, 2025; Revised: March 23, 2026

Abstract: This paper proposes some new 4D fractional-order hyperchaotic Rabinovich systems with Caputo derivatives. Using an exhaustive computer search, 20 simple hyperchaotic systems are found according to system parameters, initial conditions, and fractional-order derivatives of the 4D fractional-order Rabinovich system. These 20 systems are listed in this paper, and based on the Lyapunov exponents, the basic dynamical behaviors of these 20 systems have been investigated. By designing linear and nonlinear feedback controllers, the problems of local and global asymptotic stabilization are investigated for the first system of the proposed hyperchaotic systems. Furthermore, the numerical simulations show the feasibility and the effectiveness of the results.

Keywords: *fractional-order derivative; hyperchaotic Rabinovich system; Lyapunov exponents; feedback controller.*

Mathematics Subject Classification (2020): 34C28, 37D45, 37M22, 70K20, 93-04.

1 Introduction

Hyperchaos, characterized as a chaotic system with at least two positive Lyapunov exponents, has attracted many researchers due to its potential applications in science and engineering, such as neural networks, generation, control, synchronization, secure communications, lasers, image encryption [15], and so on. The hyperchaotic system is a higher dimensional chaotic system; its dynamics are richer and more extended in the phase plane, it has more complex behavior and abundant dynamics than chaotic systems.

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