



# On the Boundedness of a Novel Four-Dimensional Hyperchaotic System

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**Abstract:** To estimate the ultimate bound and positively invariant set for a dynamical system is an important but quite challenging task in general. This paper attempts to investigate the bounds of a novel four-dimensional hyperchaotic system using a technique combining the generalized Lyapunov function theory and the Lagrange multiplier method. Finally, a numerical example is provided to illustrate the main result.

**Keywords:** *4D hyperchaotic system; boundedness of solutions; Lyapunov stability; Lagrange multiplier method.*

**Mathematics Subject Classification (2010):** 65P20, 65P30, 65P40.

## 1 Introduction

Hyperchaos characterized by more than one positive Lyapunov exponent has attracted an increasing attention of various scientific and engineering communities. It is very important to generate hyperchaos with more complicated dynamics as a model for theoretical research and practical implication. Hyperchaos was firstly reported by Rossler [18] in 1979, and the first circuit implementation of hyperchaos was realized by Matsumoto et al. [10]. Since then, some other hyperchaos generators have also been found. Typical examples are the hyperchaotic Lorenz–Haken system [11], hyperchaotic Chua’s circuit [6], hyperchaotic modified Chua’s circuit [20], these examples in themselves indicate that hyperchaos has a board range of applications in such fields as nonlinear circuit [2], secure communications [21], lasers [22], neural network [1], control [4], synchronization [5] and so on. In fact, the study of hyperchaos has recently become a central topic of the research in nonlinear sciences.

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