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Boundedness Results for a New Hyperchaotic System and Their Application in Chaos Synchronization

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Abstract: In this paper, we attempt to investigate the boundedness of a new hyperchaotic system using the combination of the Lyapunov stability theory with the comparison principle method. Furthermore, explicit estimation of the two-dimensional parabolic ultimate bound with respect to x-z is established. Finally, a linear feedback approach with one input is used to realize the global synchronization of two four-dimesional hyperchaotic systems. Some numerical simulations are also used to verify the effectiveness and correctness of the proposed scheme.

Keywords: *4D hyperchaotic system; boundedness of solutions; Lyapunov stability; chaos synchronization; comparison principle method.*

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

1 Introduction

Hyperchaotic systems are dissipative nonlinear dynamical systems with more than one positive Lyapunov exponent. The Lyapunov exponent of a chaotic system is a measure of the divergence of points which are initially very close and this can be used to quantify chaotic systems. So, the hyperchaos may be more useful in some fields such as communication encryption, and so forth.

An important paradigm of a 3-D chaotic system was discovered by Lorenz [7] while he was studying a 3-D weather model. Subsequently, many chaotic systems have attracted tremendous research interest, and many chaotic and hyperchaotic systems have been presented.

Chaotic systems are ultimately bounded. Thus, the phase portraits of the systems will be ultimately trapped in some compact sets. The ultimate boundedness of a chaotic

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