



On the Synchronization of a Novel Chaotic System with Two Control Methods

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Received: January 14, 2024; Revised: July 17, 2024

Abstract: This paper reports a new chaotic system and its synchronization via active and adaptive control methods. The novel system is presented and its chaoticity is confirmed using the Lyapunov exponents tool. Furthermore, it is demonstrated that the new system possesses the property of co-existing attractors. Moreover, two control methods are employed: active control and adaptive control. By designing appropriate controllers and estimation laws based on the stability theory of integer-order systems, we achieve synchronization between chaotic systems. Finally, numerical simulations are implemented to demonstrate the effectiveness and flexibility of the synchronization controllers and the estimation laws for the two methods.

Keywords: *chaotic system; strange attractor; Lyapunov exponent; Lyapunov stability theory; adaptive control; synchronization.*

Mathematics Subject Classification (2010): 34D08, 34C28, 37B55, 37B25, 37D45, 70K20, 93D05, 93D21.

1 Introduction

The chaos theory deals with the dynamical behavior of nonlinear dynamical systems which are highly sensitive to initial conditions and system parameters. Recently, chaos theory has achieved great development and has been successfully applied in many fields such as electronic engineering [1], computer science [2], communication systems [3, 4], medical image processing [1,2], complex networks [5], chemical engineering [6], investigation of HIV virus [28] and economic models [7]. By now, numerous chaotic systems with different types of attractors have been proposed and studied, for example those with

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