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A New Fractional-Order 3D Chaotic System Analysis and Synchronization

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Abstract: In this work, a fractional-order form of a novel 3D chaotic system is introduced. Firstly, this fractional system can display chaotic behavior for a given minimal commensurate order. Secondly, theoretical and numerical solution representation is given by exploiting the Adams–Bashforth–Moulton algorithm for the presented novel fractional-order system. Thirdly, we have studied full-state hybrid projective synchronization (FSHPS) type the novel 3D fractional-order system and the fractional-order hyper-chaotic Lorenz system based on the definition of this kind of synchronization and the Lyapunov theory of stability of linear fractional-order systems. Finally, numerical simulations are given to show the effectiveness of the proposed controller via the improved Adams–Bashforth–Moulton algorithm.

Keywords: *fractional-order system; chaotic system; FSHPS; Lyapunov theory; synchronization.*

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1 Introduction

During these years the synchronization of chaotic dynamical systems has generated a great interest among researchers in nonlinear sciences, in view of its practical applications, many types of synchronization have been reported in the literature; these include complete, generalized, anticipated, lag, measure, projective, phase, reduced order and adaptive synchronizations. These concepts of synchronization have led to the creation of many methods of controlling chaos and synchronization by many researchers, including

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