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Different Schemes of Coexistence of Full State Hybrid Function Projective Synchronization and Inverse Full State Hybrid Function Projective Synchronization

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Abstract: This paper presents new synchronization schemes, which assure the co-existence of the full-state hybrid function projective synchronization (FSHFPS) and the inverse full-state hybrid function projective synchronization (IFSHFPS) between wide classes of three-dimensional master systems and four-dimensional slave systems. In order to show the capability of co-existence approaches, numerical examples are reported, which illustrate the co-existence of FSHFPS and IFSHFPS between 3D chaotic system and 4D hyperchaotic system in different dimension.

Keywords: *chaos; full-state hybrid function projective synchronization; inverse full-state hybrid function projective synchronization; co-existence; Lyapunov stability.*

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1 Introduction

Synchronization refers to a process wherein two dynamical systems (master and slave systems, respectively) adjust their motion to achieve a common behavior, mainly due to a control input [1]. The issue of synchronization of chaotic dynamical systems was first studied by Pecora and Carroll [2]. By considering the historical timeline of the topic, it can be observed that a large variety of synchronization types has been proposed such as matrix projective synchronization [3], generalized synchronization [4], inverse generalized synchronization [5], $\Lambda - \phi$ generalized synchronization [6,7] and $\Phi - \Theta$ synchronization [8,9] and so on. Among the different types, *full state hybrid projective synchronization* (FSHPS) has been introduced, wherein each slave system variable synchronizes with a linear combination of master system variables [10]. Different types

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