



Co-existence of Various Types of Synchronization Between Hyper-chaotic Maps

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Abstract: In this paper, we propose a new type of hybrid synchronization combining projective synchronization (PS), full state hybrid projective synchronization (FSHPS) and generalized synchronization (GS). We present, based on nonlinear controllers, a new control scheme to study the co-existence of (PS), (FSHPS) and (GS) between general 3D hyperchaotic maps. The capability of the proposed approach is illustrated by numerical example.

Keywords: *hyperchaotic maps; synchronization; co-existence; Lyapunov stability.*

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1 Introduction

Historically, hyperchaos in discrete-time systems was firstly reported by Rössler [1]. A hyperchaotic system is usually defined as a chaotic system with more than one positive Lyapunov exponent. The occurrence of hyperchaotic behavior has been found in an electronic circuit [2], NMR laser [3], in a semi-conductor system [4] and in a chemical reaction system [5]. Some interesting hyperchaotic systems in discrete-time were presented in the past two decades such as Baier-Klain system [6], Hitzl-Zele map [7], Stefanski map [8], Wang map [9], Rössler discrete-time system [10] and Grassi-Miller map [11] etc. Since hyperchaotic maps are more complex than chaotic maps, their dynamics have been investigated extensively owing to their useful potential applications in

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