



# Coexistence of Different Types of Chaos Synchronization Between Non-Identical and Different Dimensional Dynamical Systems

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Received: April 30, 2018; Revised: July 12, 2018

**Abstract:** In this paper, based on Lyapunov stability theory, the coexistence of full state hybrid projective synchronization (FSHPS),  $\Phi - \Theta$  synchronization, generalized synchronization (GS) and Q-S synchronization between different dimensional chaotic systems is studied. An application example and numerical simulations are presented to validate the main results of this paper.

**Keywords:** chaos; full state hybrid projective synchronization;  $\Phi - \Theta$  synchronization; generalized synchronization; Q-S synchronization.

**Mathematics Subject Classification (2010):** 37B25, 37B55, 93C55, 93D05.

## 1 Introduction

Over the last few decades, a great deal of attention has been paid to the subject of chaotic dynamical systems and their synchronization control. Synchronization is an adaptive process that works to force the variables of a chaotic slave system to follow those of a corresponding master system [1]. This considerable interest has resulted in many synchronization types and schemes, see [2–5]. Among the most effective types of synchronization for chaotic and hyperchaotic systems are the full state hybrid projective synchronization (FSHPS) [6],  $\Phi - \Theta$  synchronization [7, 8], generalized synchronization (GS) [9] and Q-S synchronization [10]. As a natural consequence of defining a variety

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