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On Synchronization, Anti-synchronization and Hybrid Synchronization of 3D Discrete Generalized Hénon Map

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Abstract: Suitable stabilization conditions obtained for continuous chaotic systems are generalized, in this paper, to discrete-time chaotic systems. The proposed approach, leading to these conditions for complete synchronization, anti-synchronization and hybrid synchronization phenomena studies, is based on the use of state feedback and aggregation techniques for stability and stabilizability studies associated with the Benrejeb arrow form matrix for system description. The results, easy to use, are successfully applied for two identical 3D generalized Hénon maps.

Keywords: *hyperchaotic discrete-time systems; stability; Benrejeb arrow form matrix; complete synchronization; anti-synchronization; hybrid synchronization.*

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1 Introduction

Chaos synchronization has received a significant attention due to its potential applications [12, 27] in various fields, for instance, application to control theory, secure communication, chemical reaction and encoding message [13, 24]. There exist many types of synchronization, such as Complete Synchronization (CS) [27], Anti-Synchronization (AS) [19], Hybrid Synchronization (HS) [21, 22], Phase Synchronization [29], Lag Synchronization [30], Generalized Synchronization [31], Projective Synchronization [25] and Q-S Synchronization [32].

Given the two following chaotic systems:
the master one:

$$x_m(k+1) = F(x_m(k)), \tag{1}$$

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