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Adaptive Hybrid Function Projective Synchronization of Chaotic Space-Tether System

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Abstract: In this paper, we have achieved adaptive hybrid function projective synchronization between two identical chaotic space-tether systems with uncertain time-varying parameters and with each system evolving from different initial conditions by applying adaptive control technique. Based on Lyapunov stability theory, adaptive control laws and parameter update laws for estimating the uncertain, time-varying parameters are derived to make the states of the two identical chaotic systems asymptotically synchronized. Complete synchronization, antisynchronization, hybrid projective synchronization are obtained as special cases from the above synchronization method. The control techniques and the proposed update laws are verified by numerical simulation results.

Keywords: *adaptive control; parameter estimation; hybrid function projective synchronization; Lyapunov stability theory; space-tether system, celestial mechanics.*

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1 Introduction

Two identical chaotic systems with different initial conditions were first made to synchronize in 1990 by Pecora and Carroll [25]. Since then, chaos synchronization has attracted a great deal of attention from various scientific fields. The idea of synchronization is to use the output of the master system to control the slave system so that the output of the response system follows the output of the master system asymptotically. Many methods and techniques for handling chaos control and synchronization of various chaotic systems have been developed such as PC method [25], OGY method [19], time-delay feedback approach [24], feedback approach [9, 14], backstepping design technique [29],

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