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# INVERSE MATRIX PROJECTIVE SYNCHRONIZATION OF NOVEL HYPERCHAOTIC SYSTEM WITH HYPERBOLIC SINE FUNCTION NON-LINEARITY

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**Abstract.** In this paper, we investigate the inverse matrix projective synchronization (IMPS) of novel hyperchaotic system with hyperbolic sine function non-linearity. Recall that the studied system is generated from the modified Lü system. First, hyperchaotic attractors, symmetry, dissipation, equilibrium points and Lyapunov spectrum are the tools used to analyse this system. Moreover, this paper presents an active controller to achieve the IMPS analysis of the system. The main results are established by using Lyapunov stability theory, and finally numerical example and computer simulations are shown to illustrate all the main results.

**Keywords.** Hyperbolic sine function, Hyperchaotic Lü system, Active control, Lyapunov exponent, inverse matrix projective synchronization.

**AMS subject classification:** 34A34, 37B25, 37B55, 93C55, 37C25.

## 1 Introduction

Grace to the natural properties of chaotic and hyperchaotic systems, such as: sensitivities of initial conditions, boundedness and infinite recurrence, hyperchaotic systems have become good condidat for important applications in several areas such as: cryptosystems, secure communications, network signal transmission, electrical circuits and encryption [8, 12, 13, 23, 26], etc.

Chaos synchronization plays an important role in nonlinear science and must consider several aspects, such as physical systems [11], ecological systems [3] and biological systems [10], etc. For this, many different methods have been used to study the synchronization and stability of general uncertain systems, such as impulsive control, adaptive control, Adaptive fuzzy control, active control, prediction-based feedback control, sliding mode control [2, 5, 6, 17, 21, 22, 24] and so on. Different types of synchronization