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Spatiotemporal chaos in mixed linear-nonlinear Two-Dimensional coupled logistic map lattice

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Highlights

- A new system was proposed by using mixed linear-nonlinear coupling based on 2DCML.
- The 2DCML system is a special case of the proposed system.
- The new chaotic features of the proposed system are superior to 2DCML and MLNCML.

Abstract: We investigate a new spatiotemporal dynamics with mixing degrees of nonlinear chaotic maps for spatial coupling connections based on 2DCML. Here, the coupling methods are including with linear neighborhood coupling and the nonlinear chaotic map coupling of lattices, and the former 2DCML system is only a special case in the proposed system. In this paper the criteria such Kolmogorov-Sinai entropy density and universality, bifurcation diagrams, space-amplitude and snapshot pattern diagrams are provided in order to investigate the chaotic behaviors of the proposed system. Furthermore, we also investigate the parameter ranges of the proposed system which holds those features in comparisons with those of the 2DCML system and the MLNCML system. Theoretical analysis and computer simulation indicate that the proposed system contains features such as the higher percentage of lattices in chaotic behaviors for most of parameters, less periodic windows in bifurcation diagrams and the larger range of parameters for chaotic behaviors, which is more suitable for cryptography.

Keywords: Chaos; Spatiotemporal; Arnold Cat Map; Coupled Map Lattices

1 Introduction

Recently, the nonlinear systems has become one of the extensive research subjects, inter alia, spatiotemporal chaos, which has been applied in the many fields of physics [1-3], mathematics [4-6], biology [7], engineering and cryptography [8-21]. Since Kaneko [10-12] proposed one-dimensional Coupled Map Lattices (CML) in the year 1985, many works on such Coupled Map Lattices (CML) obtained mature theories. Sánchez et al. [13] analyzed complex patterns generated by the time evolution of a digitalized coupled map lattice. Khellat et al. [14] investigated a globally nonlocal couple map lattice of spatiotemporal chaos. Most of the spatial adjacent coupling is only spatial linear coupling between lattices. Sinha [15] proposed the random coupling of spatiotemporal system which initiated the study of the non-neighborhood coupling in coupled map lattices. Rajesh et al. [16]

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