Discrete chaos for non-conservative nonlinear coupled oscillators

Abstract for PhD seminars IMAG
(University of Granada, 14 May 2026)

Stefano Disca[1*]

[1] *Department of Mathematics and Computer Science, University of Ferrara, Via Machiavelli 30, Ferrara, 44121, Italy*
[*] *Corresponding author: dscsfn@unife.it*

We apply the Marotto-Li-Chen theorem (Marotto, 1978; Li & Chen, 2003) to prove the emergence of Li-Yorke chaos in a broad family of four-dimensional discrete dynamical systems that are naturally associated to both integrable and chaotic continuous systems. Analytical results are generalized to a modular definition of the problem and to a system of nonlinear oscillators described by polynomial potentials in one coordinate.

Chaotic behavior of the map is numerically confirmed by the rising of a confined strange attractor. Furthermore, we perform a bifurcation analysis of the system presenting 1D and 2D bifurcation diagrams, spectra of Lyapunov exponents and fractal basins of attraction.

We conjecture a novel connection between Li-Yorke chaos and KAM theory for quasi-integrable systems (Arnold, 1989), concerning the potential existence of invariant scrambled sets for perturbed Li-Yorke chaotic maps.

This talk is based on:
Disca S, Coscia V. Chaotic discretization theorems for forced linear and nonlinear coupled oscillators. Chaos, Solitons & Fractals 2026; 208: 118086. DOI: 10.1016/j.chaos.2026.118086.