Instituto Universitario de Investigación de Matemáticas y Aplicaciones Universidad Zaragoza

Departamento de Matemática Aplicada Universidad Zaragoza

# Seminario de Matemática Aplicada

# Conferencia

por:


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título:

# "Transitions to wild chaos in a four-dimensional Lorenz-like system"


**Abstract**

Wild chaos is a form of higher-dimensional chaotic dynamics that can only arise in vector fields of dimension at least four. We study wild chaos in a four-dimensional system of differential equations, which is a four-parameter extension of the classic Lorenz equations. Recently, Gonchenko, Kazakov and Turaev (2021) showed, via the computation of Lyapunov exponents, that this system has a wild chaotic attractor at a particular point in parameter space. We investigate how this wild chaotic attractor arises geometrically, performing a bifurcation analysis of the system in a two-parameter setting. As a starting point, we continue the one-parameter bifurcation structure of the classic Lorenz equations when the fourth parameter is “switched on”. We find that the well-known homoclinic explosion point of the Lorenz system unfolds and gives rise to infinite cascades of global connections in the four-dimensional system that are of Shilnikov type. These connections are formed by the unstable manifold of the origin, which still plays an essential role in the emergence of complicated dynamics in the system. We also compute the kneading diagram that encodes how this one-dimensional manifold repeatedly moves around a pair of equilibria. In combination with the direct computation of curves of global bifurcations, the kneading diagram provides insight that helps identify regions where wild chaos may occur.


**Fecha:** Miércoles, 26 de junio de 2024
**Hora:** 12:00 horas
**Lugar:** Seminario Rafael Cid, Edificio de Matemáticas, 3ª planta