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Contributions to Nonlinear Dynamics, Chaos and Complex Systems

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Nonlinear Dynamics, Chaos and Complex Systems Group of the URJC, Madrid, Spain

CHAOS 22, 047507 (2012)

Dynamics of partial control

Juan Sabuco,[1] Miguel A. F. Sanjuán,[1] and James A. Yorke[2]
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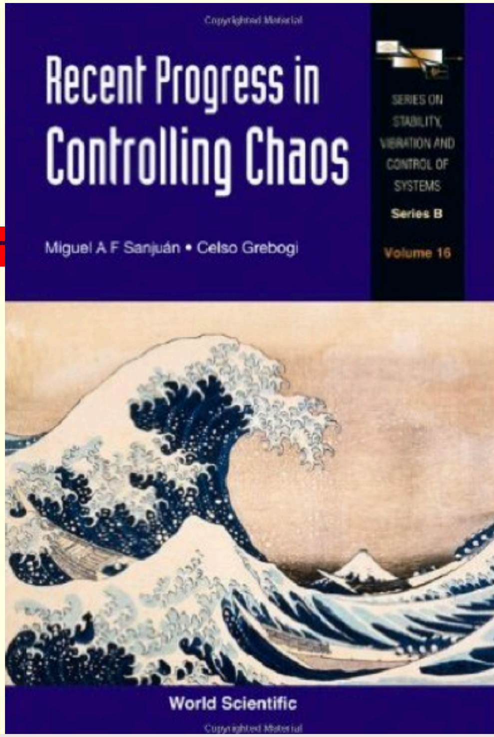
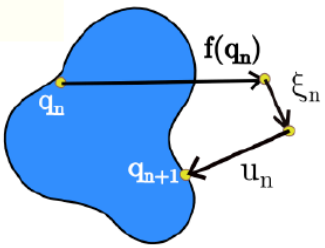
(Received 16 April 2012; accepted 10 September 2012; published online 14 December 2012)



Q compact (i.e., closed and bounded)

$$q_{n+1} = f(q_n)$$



Admissible trajectories

$$q_{n+1} = f(q_n) + \xi_n + u_n$$

for $n = 1, 2, 3, \ldots$

$$\xi_0 > u_0 > 0 \qquad |\xi_n| \leq \xi_0 \qquad |u_n| \leq u_0.$$

We call such ξ_n and u_n admissible.

DISCRETE AND CONTINUOUS DYNAMICAL SYSTEMS SERIES B
Volume 23, Number 8, October 2018
doi:10.3934/dcdsb.2018241
pp. 3237–3274

PARTIAL CONTROL OF CHAOS: HOW TO AVOID UNDESIRABLE BEHAVIORS WITH SMALL CONTROLS IN PRESENCE OF NOISE

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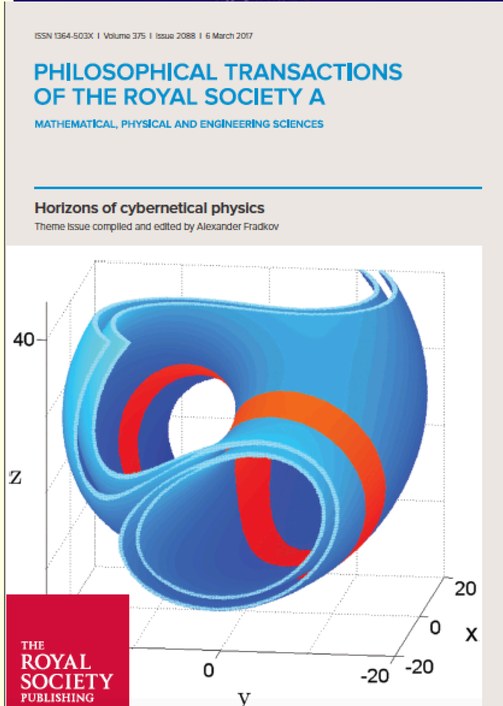

PHILOSOPHICAL TRANSACTIONS A
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Research

Partially controlling transient chaos in the Lorenz equations

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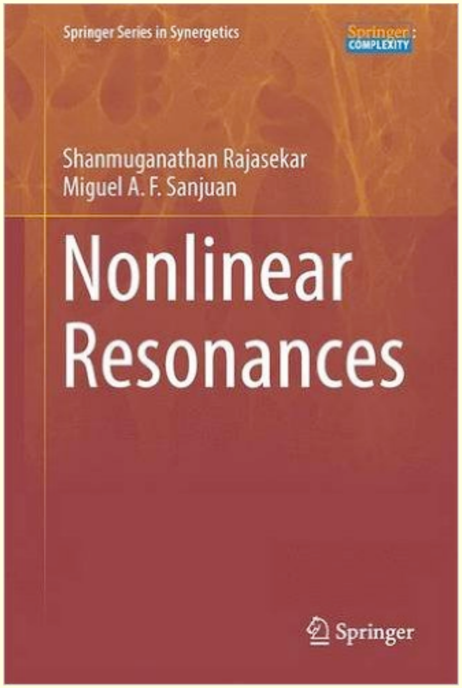
Cite this article: Capeáns R, Sabuco J, Sanjuán MAF, Yorke JA. 2017 Partially controlling transient chaos in the Lorenz equations. *Phil. Trans. R. Soc. A* **375**: 20160211.

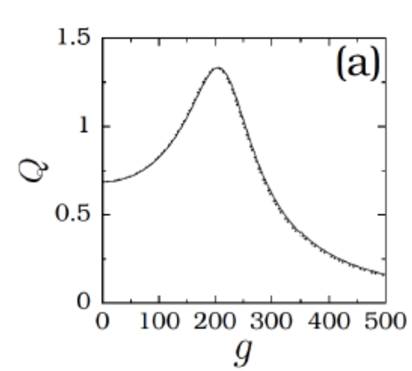
Vibrational Resonance and Nonlinear Resonances

$$\dot{x} = f(x) + \varepsilon \cos \omega t + \xi(t)$$

- A. $\xi(t)$ is a noise — **SR**
- B. $\xi(t) = g \cos \Omega t \quad \Omega >> \omega$ — **VR**
- C. $\xi(t)$ is a chaotic signal — **CR**



$$\ddot{x} + d\dot{x} + \omega_0^2 x + \beta x^3 = f \cos \omega t + g \cos \Omega t \,, \quad \Omega \gg \omega$$



Fractal Structures in Nonlinear Dynamics

REVIEWS OF MODERN PHYSICS, VOLUME 81, JANUARY–MARCH 2009

Fractal structures in nonlinear dynamics

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(Published 17 March 2009)

SCIENTIFIC REPORTS

OPEN

Ascertaining when a basin is Wada: the merging method

Alvar Daza[1], Alexandre Wagemakers[1] & Miguel A. F. Sanjuán[1,2,3]

Received: 15 March 2018
Accepted: 18 June 2018
Published online: 02 July 2018

Trying to imagine three regions separated by a unique boundary seems a difficult task. However, this is exactly what happens in many dynamical systems showing Wada basins. Here, we present a new perspective on the Wada property: *A Wada boundary is the only one that remains unaltered under the action of merging the basins*. This observation allows to develop a new method to test the Wada property, which is much faster than the previous ones. Furthermore, another major advantage of the merging method is that a detailed knowledge of the dynamical system is not required.

SCIENTIFIC REPORTS

OPEN

Basin entropy: a new tool to analyze uncertainty in dynamical systems

Received: 13 June 2016
Accepted: 18 July 2016
Published: 12 August 2016

Alvar Daza[1], Alexandre Wagemakers[1], Bertrand Georgeot[2], David Guéry-Odelin[3] & Miguel A. F. Sanjuán[1]

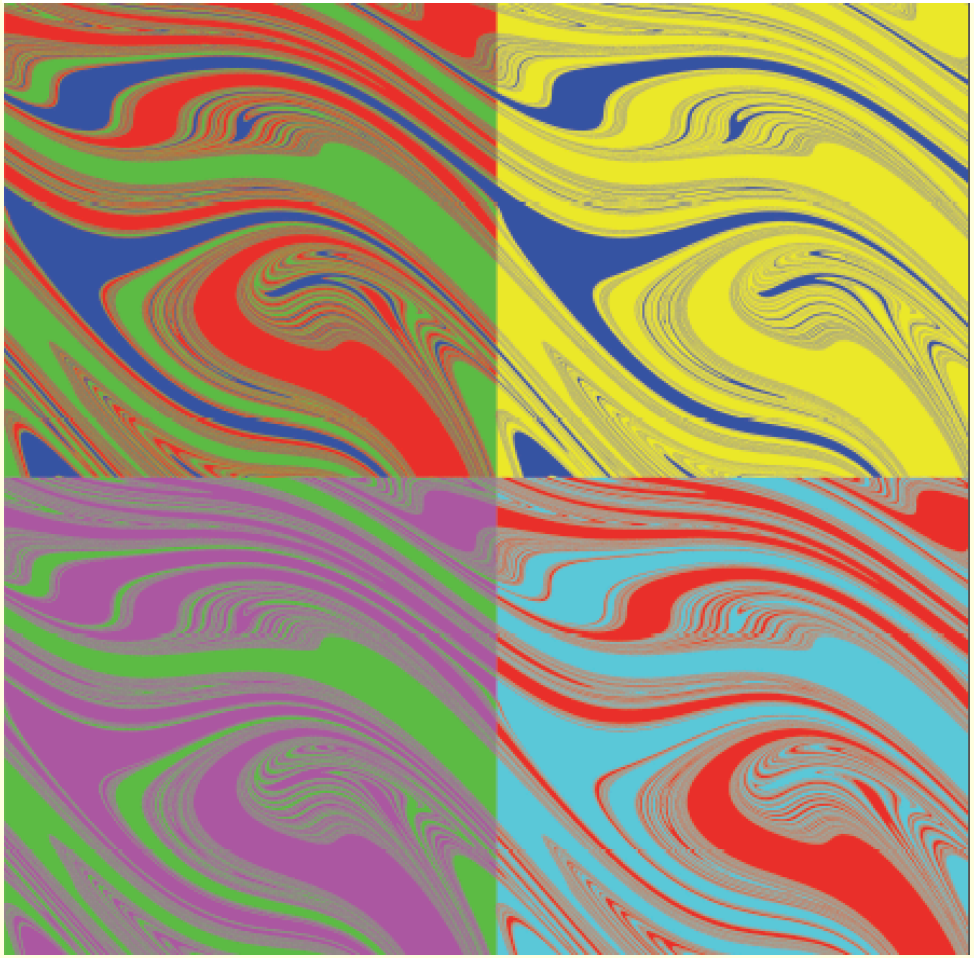
IOP PUBLISHING REPORTS ON PROGRESS IN PHYSICS

Rep. Prog. Phys. **76** (2013) 016001 (53pp) doi:10.1088/0034-4885/76/1/016001

New developments in classical chaotic scattering

Jesús M Seoane and Miguel A F Sanjuán

Nonlinear Dynamics, Chaos and Complex Systems Group, Departamento de Física, Universidad Rey Juan Carlos, Tulipán s/n, 28933 Móstoles, Madrid, Spain



Modeling Biological Systems

Physics Reports 501 (2011) 1–74

Contents lists available at ScienceDirect

Physics Reports

journal homepage: www.elsevier.com/locate/physrep

Map-based models in neuronal dynamics

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Journal of Theoretical Biology 349 (2014) 74–81

Contents lists available at ScienceDirect

Journal of Theoretical Biology

journal homepage: www.elsevier.com/locate/yjtbi

Avoiding healthy cells extinction in a cancer model

Álvaro G. López [a], Juan Sabuco [a], Jesús M. Seoane [a], Jorge Duarte [b], Cristina Januário [b], Miguel A.F. Sanjuán [a,*]

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Commun Nonlinear Sci Numer Simulat 70 (2019) 307–317

Contents lists available at ScienceDirect

Commun Nonlinear Sci Numer Simulat

journal homepage: www.elsevier.com/locate/cnsns

Research paper

Nonlinear cancer chemotherapy: Modelling the Norton-Simon hypothesis

Álvaro G. López [a], Kelly C. Iarosz [b,c], Antonio M. Batista [d], Jesús M. Seoane [a,*], Ricardo L. Viana [e], Miguel A.F. Sanjuán [a,f]

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Ecological Complexity 19 (2014) 1–8

Contents lists available at ScienceDirect

Ecological Complexity

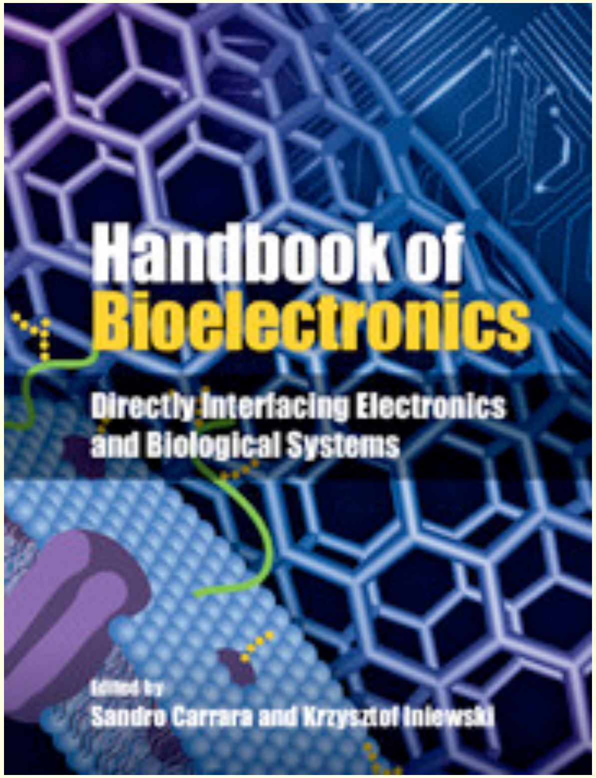
journal homepage: www.elsevier.com/locate/ecocom

Original Research Article

When less is more: Partial control to avoid extinction of predators in an ecological model

Rubén Capeáns, Juan Sabuco, Miguel A.F. Sanjuán [*]

Nonlinear Dynamics, Chaos and Complex Systems Group, Departamento de Física, Universidad Rey Juan Carlos, Tulipán s/n, 28933 Móstoles, Madrid, Spain



Applications in Physics: Galactic Dynamics, Chaos & Entanglement, Cold Atoms, Black Holes

A&A 595, A68 (2016)
DOI: 10.1051/0004-6361/201629206

Astronomy & Astrophysics

Role of dark matter haloes on the predictability of computed orbits

Juan C. Vallejo[1,2] and Miguel A. F. Sanjuan[2]

Monthly Notices of the ROYAL ASTRONOMICAL SOCIETY
MNRAS **447**, 3797–3811 (2015) doi:10.1093/mnras/stu2733

The forecast of predictability for computed orbits in galactic models

J. C. Vallejo[1,2★] and M. A. F. Sanjuán[2]
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Physics Letters A 378 (2014) 2603–2610
Contents lists available at ScienceDirect
Physics Letters A
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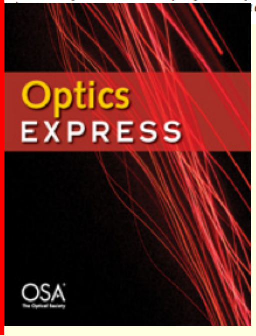
Impact of quantum–classical correspondence on entanglement enhancement by single-mode squeezing

Sijo K. Joseph[a], Lock Yue Chew[b], Miguel A.F. Sanjuán[a,*]
[a] Nonlinear Dynamics, Chaos and Complex Systems Group, Depar



The effect of geometry on the classical entanglement in a chaotic optical fiber

Sijo K. Joseph[1*] and Juan Sabuco[1] and Lock Yue Chew[2] and Miguel A. F. Sanjuán[1]
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Juan C. Vallejo
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Predictability of Chaotic Dynamics

A Finite-time Lyapunov Exponents Approach

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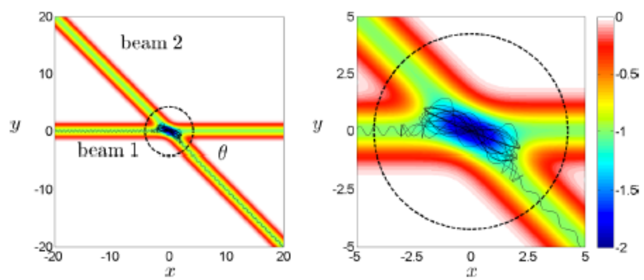
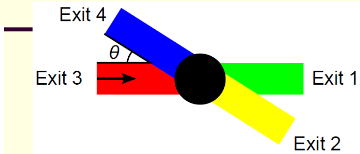
PHYSICAL REVIEW A 95, 013629 (2017)

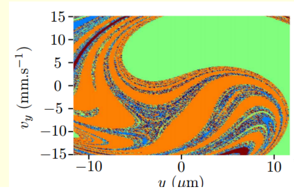
Chaotic dynamics and fractal structures in experiments with cold atoms

Alvar Daza,[1] Bertrand Georgeot,[2] David Guéry-Odelin,[3] Alexandre Wagemakers,[1] and Miguel A. F. Sanjuán[1,*]



(a) (b)

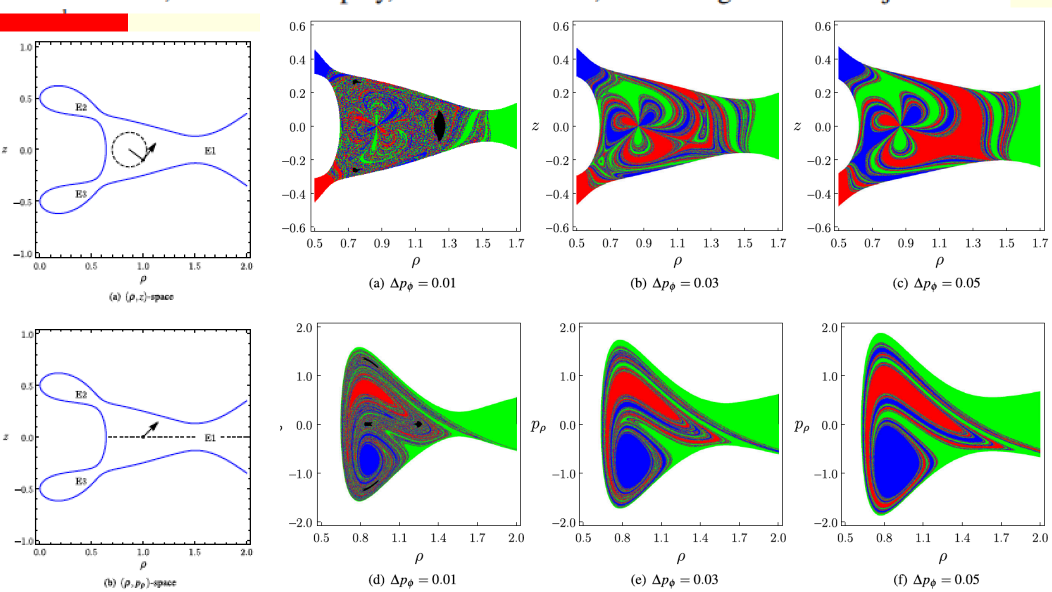




PHYSICAL REVIEW D 98, 084050 (2018)

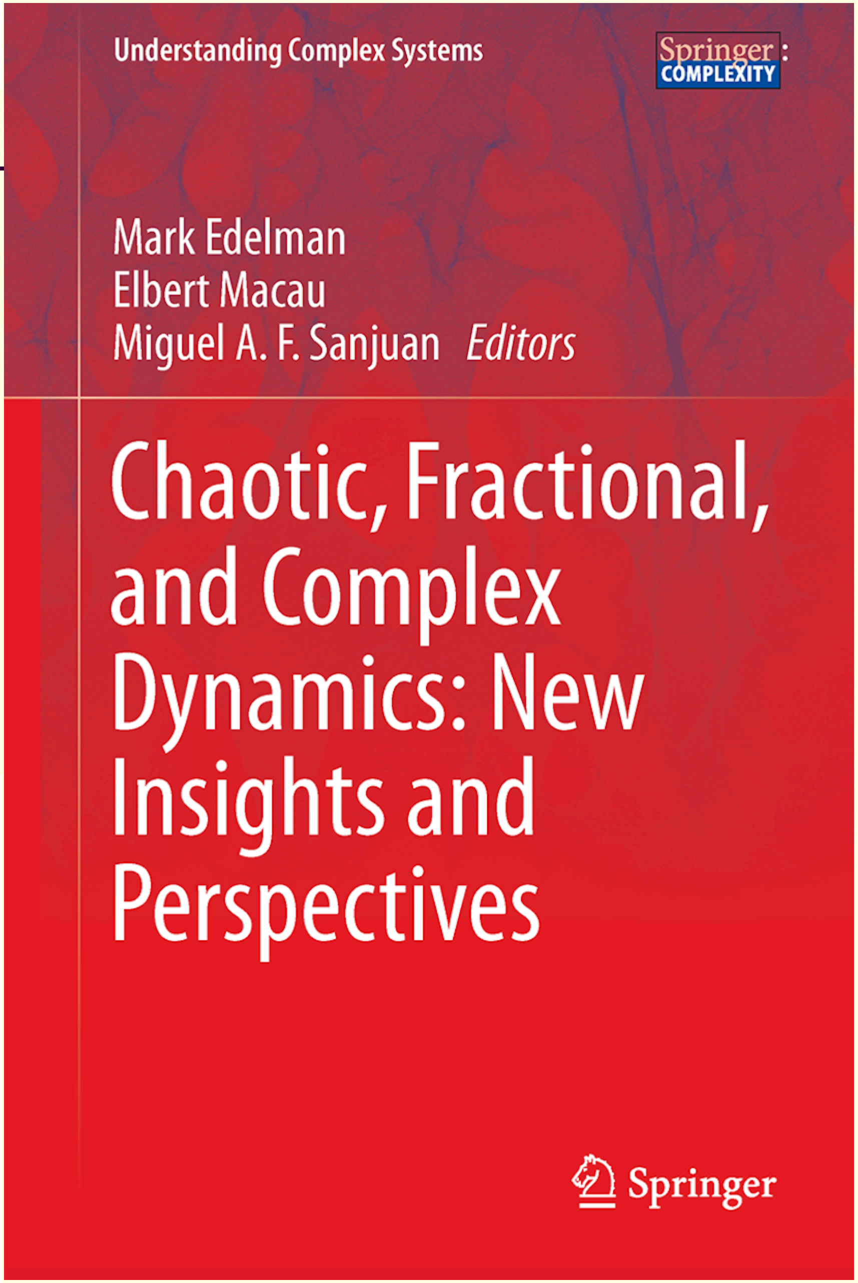
Wada structures in a binary black hole system

Álvar Daza,[1,*] Jake O. Shipley,[2,†] Sam R. Dolan,[2,‡] and Miguel A. F. Sanjuán[1,3,4,§]



(a) (ρ, z)-space (a) $\Delta p_\phi = 0.01$ (b) $\Delta p_\phi = 0.03$ (c) $\Delta p_\phi = 0.05$

(b) (ρ, p_ρ)-space (d) $\Delta p_\phi = 0.01$ (e) $\Delta p_\phi = 0.03$ (f) $\Delta p_\phi = 0.05$



Foundations of Nonlinear Dynamics & Chaos Theory

CHAOS **28**, 103110 (2018)

Low-dimensional paradigms for high-dimensional hetero-chaos

Yoshitaka Saiki,[1,2,3] Miguel A. F. Sanjuán,[3,4] and James A. Yorke[3,5]
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(Received 22 June 2018; accepted 26 September 2018; published online 18 October 2018)

The dynamics on a chaotic attractor can be quite heterogeneous, being much more unstable in some regions than others. Some regions of a chaotic attractor can be expanding in more dimensions than other regions. Imagine a situation where two such regions and each contains trajectories that stay in the region for all time—while typical trajectories wander throughout the attractor. Furthermore, if arbitrarily close to each point of the attractor there are points on periodic orbits that have different unstable dimensions, then we say such an attractor is "hetero-chaotic" (i.e., it has heterogeneous chaos). This is hard to picture but we believe that most physical systems possessing a high-dimensional attractor are of this type. We have created simplified models with that behavior to give insight into real high-dimensional phenomena. *Published by AIP Publishing.* https://doi.org/10.1063/1.5045693

Feature Articles

International Journal of Bifurcation and Chaos, Vol. 28, No. 12 (2018) 1830039 (11 pages)

DOI: 10.1142/S0218127418300392

Computing Complex Horseshoes by Means of Piecewise Maps

Álvaro G. López*,‡, Álvar Daza*, Jesús M. Seoane*
and Miguel A. F. Sanjuán*,†
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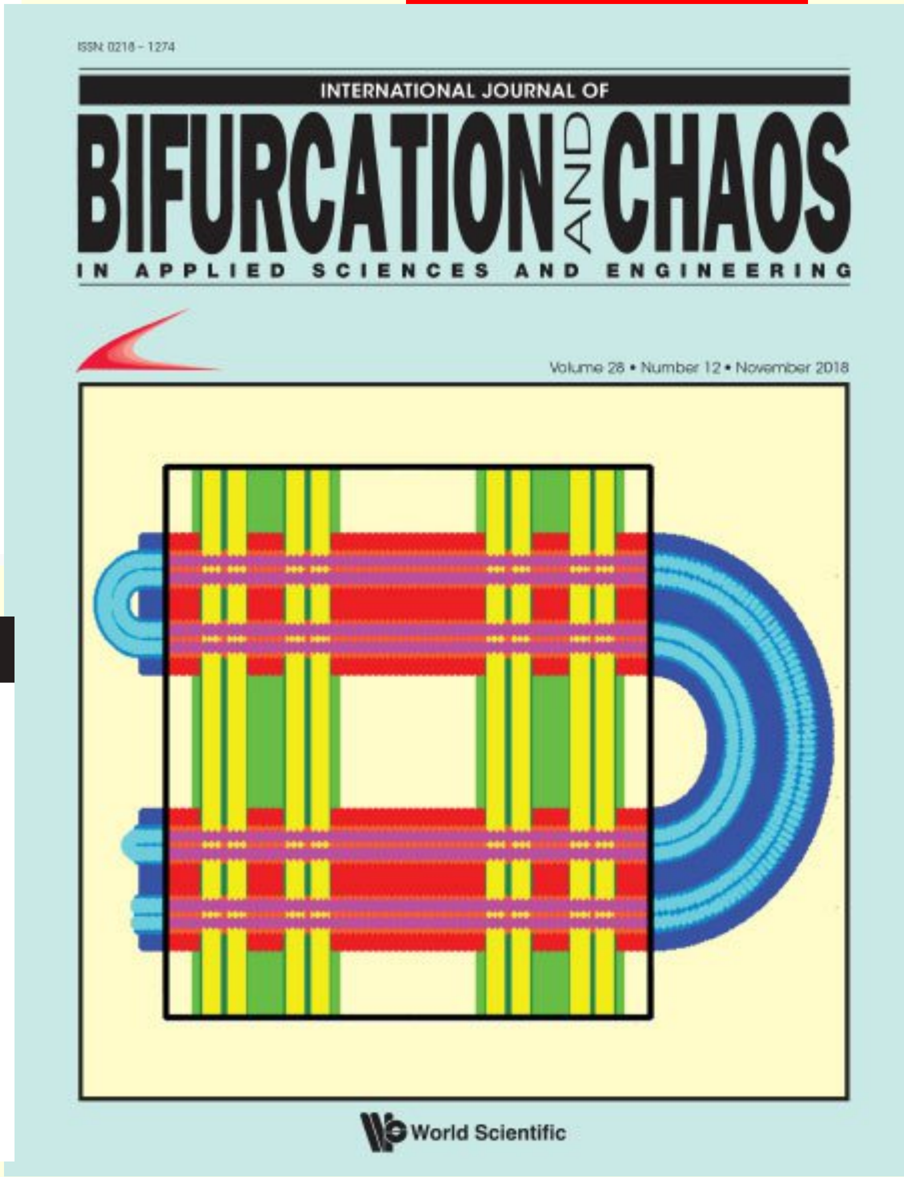

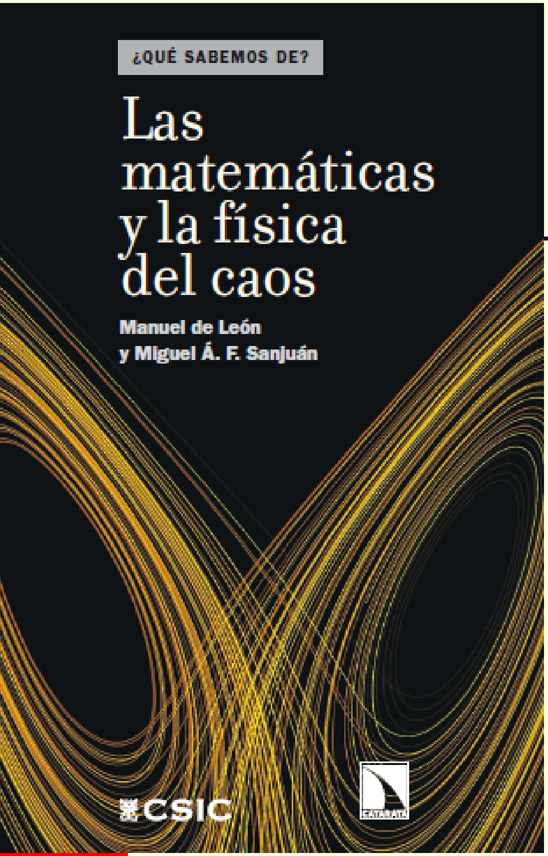

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Explorations on the Science of Complex Systems

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