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Periodic orbit analysis at the onset of the unstable dimension variability and at the blowout bifurcation

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(Submitted on 12 Nov 2009)

Many chaotic dynamical systems of physical interest present a strong form of nonhyperbolicity called unstable dimension variability (UDV), for which the chaotic invariant set contains periodic orbits possessing different numbers of unstable eigendirections. The onset of UDV is usually related to the loss of transversal stability of an unstable fixed point embedded in the chaotic set. In this paper, we present a new mechanism for the onset of UDV, whereby the period of the unstable orbits losing transversal stability tends to infinity as we approach the onset of UDV. This mechanism is unveiled by means of a periodic orbit analysis of the invariant chaotic attractor for two model dynamical systems with phase spaces of low dimensionality, and seems to depend heavily on the chaotic dynamics in the invariant set. We also described, for these systems, the blowout bifurcation (for which the chaotic set as a whole loses transversal stability) and its relation with the situation where the effects of UDV are the most intense. For the latter point, we found that chaotic trajectories off, but very close to, the invariant set exhibit the same scaling characteristic of the so-called on-off intermittency.

Comments:	32 pages (preprint format), 9 figures
Subjects:	**Chaotic Dynamics (nlin.CD)**
Journal reference:	Chaos, 17:023131(13) (2007)
DOI:	10.1063/1.2748619
Cite as:	**arXiv:0911.2439v1 [nlin.CD]**

Submission history

From: Sandro Ely de Souza Pinto [view email]
[v1] Thu, 12 Nov 2009 18:15:40 GMT (486kb)

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