Duffing-van der Pol系统的随机分岔

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摘要　　应用广义胞映射图论方法(GCMD)研究了在谐和激励与随机噪声共同作用下的Duffing-van der Pol系统的随机分岔现象. 系统参数选择在多个吸引子与混沌鞍共存的范围内. 研究发现，随着随机激励强度的增大, 该系统存在两种分岔现象：一种为随机吸引子与吸引域边界上的鞍碰撞，此时随机吸引子突然消失；另一种为随机吸引子与吸引域内部的鞍碰撞，此时随机吸引子突然增大. 研究证实，当随机激励强度达到某一临界值时，该系统还会发生D-分岔(基于Lyapunov指数符号的改变而定义)，此类分岔点不同于上述基于系统拓扑性质改变所得的分岔点.

关键词　　随机分岔,广义胞映射,D-分岔,混沌鞍,最大Lyapunov指数

分类号　　0322

Stochastic bifurcation in a duffing-van der pol system

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Abstract

  Stochastic bifurcation of a Duffing-van der Pol system subject to a deterministic harmonic excitation and bounded noise is studied by using the generalized cell mapping method with diagraphes. System parameters are chosen in the range of two co-existing attractors and a chaotic saddle, during their evolution. It is found that stochastic bifurcation mostly occurs when a stochastic attractor collides with a stochastic saddle. In our study, two kinds of discontinuous bifurcations are found according to the abrupt increase or disappearance of the attractor when it collides with the saddle in the basin interior or on the boundary. Our study also reveals that the bifurcation value is different from that of D-bifurcation which is defined by the change of the sign of the top Lyapunov exponent.

Key words　　stochastic bifurcation　the generalized cell mapping　D-bifurcation　chaotic saddle　top Lyapunov exponent

DOI:

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