论文

由单变量受扰观测序列估计非线性系统重影轨迹

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摘要
同宿切面和同宿截面的存在使得非双曲线型非线性系统重影轨迹的估计变得十分困难。该文在充分挖掘非线性系统本身特性的基础上，提出了一种估计非双曲线型非线性系统重影轨迹的新方法。不同于以往算法，该方法首先计算受扰序列的局部稳定流和不稳定流方向，进而确定同宿切面存在的位置，很大程度上降低了同宿切面对算法性能的影响，并可精确确定重影轨迹的长度；也不同于现有文献忽视同宿截面对算法性能影响的做法，该文研究得出同宿截面点间的最小距离和干扰噪声幅度二者间的关系，首次定量地估计了同宿截面点可能对算法造成的影响，这无疑对其它算法也将是一个有益的启示。

关键词　非双曲线型非线性系统　轨迹重影　局部稳定流　同宿切面　同宿截面

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Estimation of Shadowing Trajectory of the Nonlinear Systemfrom a Noisy Scalar Series

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Abstract
The presence of homoclinic tangencies and homoclinic intersection makes it very difficult, sometimes even impossible, to estimate the shadowing trajectory of the non-hyperbolic nonlinear system. A new algorithm for shadowing the non-hyperbolic nonlinear system is presented in this paper, which is geometrical in nature and tries to exploit the properties of the chaotic systems. Different from former methods, this method computes the stable and unstable manifolds of the noisy trajectory firstly, and then the locations of the homoclinic tangencies are determined. Thus the effects of the homoclinic tangencies on the algorithm can be decreased to a great extent, and the length of the shadowing trajectories are estimated by the locations of these homoclinic tangencies. Also different from those methods which take it as granted that the mechanism of failure of shadowing algorithms is related with the homoclinic tangencies only, experiments in this paper demonstrate a quantitative relation between the minimal distance of homoclinic intersections and the amplitude of noise. Thus the probability that the algorithm converges to the true trajectory can be boosted efficiently, and without any doubts, this strategy can be as a heuristic approach to other methods.

Key words　Non-hyperbolic nonlinear system　Shadowing trajectory　Local stable manifolds　Homoclinic tangencies　Homoclinic intersection

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