Geophysical Research Abstracts, Vol. 8, 06966, 2006
SRef-ID: 1607-7962/gra/EGU06-A-06966
© European Geosciences Union 2006

Prognosis of bifurcations of a dynamical system by noisy chaotic time series

A.M. Feigin (1), E.M. Loskutov (1), Ya.I. Molkov (1), and D.N. Mukhin (1)

(1) Institute of Applied Physics, Russian Academy of Sciences, Nizhny Novgorod, Russia (feigin@appl.sci-nnov.ru / Fax: +7 8312-160616 / Phone: +7 8312-164999)

An algorithm to the prognosis of qualitative behaviour (*"prognosis of bifurcations"*) of *unknown* dynamic system (DS) is proposed. The algorithm is based on DS reconstruction by the nonlinear-dynamical analysis of a chaotic time series (TS) generated by the system. A distinctive feature of *unknown* DS reconstruction is inevitable discrepancy between the system and any model reconstructed from observed time series (TS). We describe this discrepancy as *dynamic noise*, namely, as a random quantity added to model evolution operator. Correspondingly, the Bayesian (*statistical*) approach seems to be very suitable for solution to the DS reconstruction problem. Unfortunately, being correct in terms of meeting conditions of the underlying theorem, the Bayesian approach to DS reconstruction is hard to realize in the most interesting case of chaotic TS corrupted by measurement noise. We consider a modification of the Bayesian approach that can be used for DS reconstruction from noisy TS, including the chaotic one. We propose the algorithm that adjusts the modified approach to solution of prognosis of bifurcations' problem and demonstrate that proposed algorithm allows us to predict correctly the bifurcation sequences at times longer than the duration of the observed TS, to point out the expected instants of specific bifurcation transitions and accuracy of determining these instants, as well as to calculate the probabilities to observe the predicted regimes of the system's behaviour at the time of interest. Finally we discuss limitations of the algorithm as well as possible ways of their overcoming.