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# Parameterized modeling of stochastic systems by time series and prognosis of their qualitative behavior

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Modeling of *deterministic* dynamical systems by time series has been broadly discussed in the literature for the recent 20 years. A mathematical apparatus substantiating such a possibility has been developed during these years. Different methods of constructing models of evolution operators have been proposed; basic limitations have been understood and formulated. In particular, the authors of some works demonstrated that these approaches can be used for prediction of changes in the qualitative behavior of a weakly nonautonomous system for times greater than the duration of the observed time series.

In the current work we formulate a consistent Bayesian approach to modeling *stochastic* (random) dynamical systems by time series and implement it by means of artificial neural networks. A feasibility of this approach for both, creating models adequately reproducing the observed stationary regime of system evolution and predicting changes in qualitative behavior of a weakly nonautonomous stochastic system is demonstrated on model examples. It is shown that some basic limitations arising in the case of deterministic systems may be reduced substantially for stochastic systems. In particular, we demonstrate a successful prognosis of complication of system's behavior as compared to the observed one, which is impossible in principle for deterministic dynamical systems.