Almost sure stability of stochastic gene regulatory networks with mode-dependent interval delays.

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Details

Abstract

We investigate the almost surely asymptotic stability of gene regulatory networks (GRNs) with Markovian switching. Previous research has described GRNs as coupled nonlinear stochastic systems under parametric perturbations without considering the important aspect of different time-delays in the subsystems. However, a realistic model of a GRN is that of a hybrid stochastic retarded system that represents a complex nonlinear dynamical system including mode-dependent time delays and Markovian jumping as well as noise fluctuations. In this paper, we interpret GRNs as hybrid stochastic retarded systems and prove their almost surely asymptotical stability and give upper bounds of derivatives of time delays of the subsystems. The theoretical results are elucidated in an illustrative example and thus shown how they can be applied to reverse engineering design.

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