Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Bifurcation in stochastic differential equations with delayed feedback GAUDREAULT MATHIEU, JORGE VINALS, McGill University — The bifurcation diagram of a model nonlinear Langevin equation with delayed feedback is obtained numerically. This model relates to a common motif in genetic regulatory networks, and we study the effect of fluctuating parameters on the bifurcation diagram of the network. We observe both direct and oscillatory bifurcations in different ranges of model parameters. Below threshold, the stationary distribution function $p(x)$ is a delta function at the trivial state $x = 0$. Above threshold, $p(x) \sim x^{\alpha}$ at small x, with $\alpha = -1$ at threshold, and monotonously increasing with the value of the control parameter above threshold. Unlike the case without delayed feedback, the bifurcation threshold is shifted by fluctuations by an amount that scales linearly with the noise intensity. With numerical information about time delayed correlations, we derive an analytic expression for $p(x)$ which is in good agreement with the numerical results.

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Date submitted: 19 Nov 2008 Electronic form version 1.4