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Stochastic Hopf bifurcation in transcription networks with delayed feedback JOHN WENTWORTH, Harvey Mudd College, MATHIEU GAUDREAULT, McGill University, JORGE VINALS, University of Minnesota — We study the oscillatory instabilities of two model systems that rely on delayed negative feedback to induce oscillation: a single gene auto repressor system, and a dimer negative autoregulation system. We focus on fluctuations of intrinsic origin in the range of low copy number. The bifurcation diagram is obtained for these stochastic models, and shown to differ significantly from that of a macroscopic description that neglects fluctuations. Bifurcation lines remain sharp under fluctuations, but their location is a function of the relative size of the fluctuations. Shifts in the stability threshold of the oscillators can be traced back to the interplay between statistical correlations and delayed feedback. We finally show that these results cannot be captured by weak noise approximations (the diffusion limit), but instead result from strong fluctuations associated with low copy numbers.

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