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Extreme Fluctuations in Stochastic Network Synchronization with Time Delays[1] D. HUNT, B.K. SZYMANSKI, G. KORNISS, Rensselaer Polytechnic Institute — We study the effects of nonzero time delay on the extreme fluctuations about the mean in complex networks with local relaxation dynamics in the presence of noise. This extends our previous results for average fluctuations [2,3] by considering the typical behavior of the worst-case node as the system evolves in the steady state. Within our previously established framework of the synchronizability of such systems, we consider the changes in the distribution of extremes for various delays in particular networks and the scaling behavior of the average extremal values vs. system size across ensembles of similar networks. For networks with sufficient randomness in their structure, the distribution of the global extreme is in the same universality class as that of an ensemble of independent variables, similarly to the case of zero time delay. Specifically, it asymptotically approaches the Fisher-Tippet-Gumbel extreme-value limit distribution. The local trends for individual nodes (esp. those of high degree) within the network, as well as the scaling behavior of the global extreme, however, can be adversely affected by large time delays.

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[2]D. Hunt, G. Korniss, B.K. Szymanski, PRL **105**, 068701 (2010)
[3]D. Hunt, B.K. Szymanski, G. Korniss, http://arxiv.org/abs/1209.4240

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