

Abstract Submitted
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Synchronization with Time Delays in a Noisy Environment¹ D. HUNT, G. KORNISS, B.K. SZYMANSKI, Rensselaer Polytechnic Institute — We study the effects of nonzero time delays in stochastic synchronization problems with linear couplings in an arbitrary network. We provide the synchronizability threshold using the known exact threshold value from the theory of differential equations with uniform delays and establish the limit of synchronization efficiency by constructing the scaling theory of the underlying fluctuations ². Nonzero delays lead to a scaling function for each fluctuation mode that does not vary monotonically as communication is improved (i.e., increasing strength or frequency). The strength and/or frequency of communication can then be tuned in order to subdue the stresses caused by growing the network to larger sizes, the presence of hubs, or lengthening delays. The implications can be counterintuitive: Improving communication is not always beneficial. In fact, making communication worse may salvage an otherwise unsynchronizable network. Insights into these trade-offs allow one to maintain and optimize the synchronization of the networks.

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²Hunt, Korniss, Szymanski, Phys. Rev. Lett. **105**, 068701 (2010)

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