

# SYNCHRONIZATION IN NETWORKS OF COUPLED HARMONIC OSCILLATORS WITH STOCHASTIC PERTURBATION AND TIME DELAYS\*

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## Abstract

In this paper, we investigate the leader-follower synchronization of coupled second-order linear harmonic oscillators with the presence of random noises and time delays. The interaction topology is modeled by a weighted directed graph and the weights are perturbed by white noise. On the basis of stability theory of stochastic differential delay equations, algebraic graph theory and matrix theory, we show that the coupled harmonic oscillators can be synchronized almost surely with random perturbation and time delays. Numerical examples are presented to illustrate our theoretical results.

**MSC:** 93E15, 05C82, 34C15

**keywords:** synchronization; time delay; harmonic oscillator; consensus; random noise.

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\*Accepted for publication on January 12, 2012.

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