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The Dynamics of Network Coupled Phase Oscillators: An Ensemble Approach[1] GILAD BARLEV, THOMAS ANTONSEN, EDWARD OTT, University of Maryland, College Park — We consider the dynamics of phase oscillators that interact through a coupling network. We further consider an ensemble of such systems where, for each ensemble member, the set of oscillator frequencies is randomly chosen according to a given distribution function. We then seek a statistical description of the dynamics of this ensemble. This approach allows us to apply the ansatz of Ott and Antonsen to the marginal distribution of the ensemble of states at each node. This results in a reduced set of ordinary differential equations determining these marginal distribution functions. The new set facilitates the analysis of network dynamics in several ways: (i) the time evolution of the reduced system of equations is smoother, and thus numerical solutions can be obtained much faster; (ii) the new set of equations can be used to obtaining analytical result; and (iii) for a certain type of network, a reduction to a low dimensional description of the entire network dynamics is possible. We illustrate our approach with numerical experiments on a network version of the classic Kuramoto problem, with both unimodal and bimodal frequency distributions. In the bimodal case, the dynamics are characterized by bifurcations and hysteresis involving a variety of steady and periodic attractors.

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