THE
CATHOLIC UNIVERSITY
of AMERICA

Department of Physics
Colloquium

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University of New Mexico

Cluster Synchronization in Networks with Symmetries

We first review the master stability function (MSF) approach to synchronization of networks of coupled identical oscillators. The original formulation proposed by Pecora and Carroll applies to the case that all the oscillators in the network converge on the same time-evolution (complete synchronization) and that the couplings between the oscillators are all of the same type. Here we relax both these assumptions. We first assume an arbitrary coupling topology, for which we observe the emergence of cluster synchronization. We show that the emergence of clusters can be explained in terms of the symmetries of the underlying network structure. We observe both in simulations and in an experiment an interesting phenomenon in which some clusters lose synchrony while leaving others synchronized. We apply tools from computational group theory to reveal the hidden network symmetries and predict the patterns of synchronization that can arise.

We also consider a situation in which different coupling mechanisms coexist, and each coupling mechanism can be associated with a specific network layer, which corresponds to a *hypernetwork* or *multilayer network*. We use an approach based on simultaneous block diagonalization of matrices to reduce the stability problem in a lower dimensional form. This work is in collaboration with Lou Pecora (NRL), Aaron Hagerstrom (NIST), Abu Bakar Siddique (UNM), Joe Hart (UMD), Tom Murphy (UMD), and Raj Roy (UMD).

Wednesday, September 20, 2017
4:00pm
108 Hannan Hall
Refreshments will be served at 3:45

Sponsored in part by the Graduate Student Association

For more information or if you would like to request disability accommodations, please contact:

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