SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

INFERENCE AND CONTROL OF DYNAMIC ENSEMBLE AND NETWORKED SYSTEMS

DISSERTATION DEFENSE
By

Shuo Linda Wang
PhD Candidate

Preston M. Green Department of Electrical and Systems Engineering
Washington University in St. Louis

Abstract: Complex systems in which a population of dynamic units interact with each other are prevalent in nature and human society in different scales. These systems often require an appropriate excitation, an optimal hierarchical organization, or a periodic dynamical structure, such as synchrony, to function as desired or operate optimally. In many emerging applications, such as brain stimulation and quantum pulse design, the dynamics of such population systems can only be regulated by the application of a single or sparsely distributed external inputs in order to alter their state configurations or dynamic structures. This control paradigm gives rise to challenging problems regarding robust control and computation for underactuated ensembles. The focus of this dissertation is to address theoretical and computational challenges for engineering dynamic structures in ensemble and networked systems, using both data-driven and model-based perspectives. In particular, an iterative method is presented to find optimal controls for driving ensemble systems, e.g., for pattern formation. Then, a unified data-driven method is introduced to efficiently reveal the dynamic topology and learn mathematical models of ensemble and networked systems when a reliable model is not available. To demonstrate the robustness and applicability of these model-based and data-driven methods, several practical control design and inference problems are included in this dissertation. These include the design of optimal broadband pulses in nuclear magnetic resonance (NMR) spectroscopy and imaging (MRI), and the recovery of time-varying topology of oscillatory networks for understanding functional connectivity of circadian cells or social synchronization of groups of mice.

DATE: **Wednesday, August 8, 2018**
TIME: **10:00 a.m.**
PLACE: **Green Hall, Room 0120**

Dissertation advisor:
Dr. Jr-Shin Li

This seminar is in partial fulfillment
of the Doctor of Philosophy degree

Washington University in St. Louis
SCHOOL OF ENGINEERING & APPLIED SCIENCE