
Electrical & Computer Engineering
S E M I N A R
Louisiana State University

**Inference and Control of
Ensemble and Networked Systems**

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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. In this talk, I will address theoretical and computational challenges for engineering dynamic structures in ensemble and networked systems, using both model-based and data-driven perspectives. In particular, I will present an iterative method to find optimal controls for driving ensemble systems, e.g., for pattern formation. Then, I will introduce a unified data-driven method to efficiently reveal the dynamic topology and learn mathematical models of ensemble and networked systems when a reliable model is not available. I will demonstrate the robustness and applicability of these model-based and data-driven methods through practical control design and inference problems. 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. This will be followed by the discussion of related topics and future research plans.

Bio—Shuo Wang is currently a Ph.D. candidate in Systems Science and Mathematics in the Department of Electrical and Systems Engineering at Washington University in St. Louis, where she received her M.S. in Electrical Engineering from the same department in 2013. She obtained her B.S. in Electrical Engineering with a dual degree in Financial Engineering and Economics in 2012 from Peking University, China. Her research interests lie in the areas of systems engineering, ensemble control, computational mathematics and numerical algorithms.

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Where: Room 3285 Patrick F. Taylor Hall

Info: <http://www.lsu.edu/eng/ece/seminar>

