Computer Science Seminar Series

A Network Controls Approach to Decision-Making Cyber-Human-Physical Infrastructures

Dr. Sandip Roy, Washington State University

Thursday, January 21, 2016 3:00 to 4:00pm
Venue: Computer Science 202

(Refreshments will be served at 2:45 p.m.)

Abstract – The United States’ large-scale infrastructures are foundational to the nation’s economic and social well-being. Cyber-technologies are being integrated into these critical infrastructures, which hold great promise to enable sustainable, resilient, secure, and personalized operations. My group’s research is concerned with developing decision-making (control, management) tools for these cyber-human-physical critical infrastructure networks. We approach this task from a dynamical-network-control perspective, wherein limited measurement and actuation capabilities are leveraged to shape the infrastructure’s complex propagative dynamics.

In this talk, I will first briefly overview my group’s research on dynamical-network control and its application to decision-making in critical infrastructures. I will then discuss two specific emerging management and control problems in modern critical infrastructures, to illustrate how the network control theory can be brought to bear. First, I will discuss the design of traffic management initiatives across the United States’ National Airspace System to address combined weather and man-made disruptions, which resolves to an optimal resource placement problem for a stochastic network model. Second, emerging challenges in simulation and control of transients in the electric power grid will be explored, and connected to a graphical analysis of nonminimum-phase dynamics in networks. To conclude, I will briefly discuss my vision and plans for future work.

Bio - Sandip Roy received a Bachelor’s degree from the University of Illinois at Urbana Champaign (in 1998), and Master’s and Ph.D. degrees from the Massachusetts Institute of Technology (in 2000 and 2003), all in Electrical Engineering. Since late 2003, he has been on the faculty at Washington State University, where he is currently Associate Professor and Associate Director of the School of Electrical Engineering and Computer Science, and an affiliate faculty member in the School of Global Animal Health. While at Washington State University, Sandip’s research has been focused on developing techniques for network modeling and control, and applying these techniques to support infrastructure management, cyber-physical-system control, and biological system analysis. The outcomes of this work are described in about 160 papers in leading journals (60) and conference proceedings (100). In tandem with this research effort, he has been responsible for advising graduate and precocious undergraduate students (7 Ph.D., 17 Master’s, about 10 undergraduates); teaching courses in Systems and Control Engineering, Network Science, and Cyber-Physical Systems; and supporting university recruiting and junior faculty development efforts.