

NEW PARADIGMS FOR DESIGN AND CONTROL OF DYNAMICAL NETWORKS

Yan Wan

Abstract: My research is focused on devising novel paradigms for the design and control problems in dynamical networks that arise in various infrastructure- and agent- network applications. While network structure is ubiquitous in many modern systems and so network dynamics has been systematically analyzed, works on design and control of networks (i.e., shaping the dynamics of a network through applying static/dynamic feedback controllers) are sparse. Despite the lack of works in network design and control, solutions in this field are badly needed in many network applications, such as traffic management, epidemic control, and sensor/vehicle networking.

In this presentation, I will introduce our novel approach to devise systematic solutions to design and control problems that are common to many network applications. Our philosophy is that network design and control must exploit network structure to be effective, due to the significant role played by network structures in affecting dynamics. Specifically, I will talk about our effort in two major aspects. First, I will model design and control problems in network applications using some examples (air traffic flow management and epidemic control). Second, I will illustrate our novel solutions to multiple important and typical network design and control tasks, including designing (static) network node properties and edge properties (at all or a subset of the nodes/edges), and also designing decentralized dynamical controllers, to meet eigenvalue-related performance requirements. I will also talk about our novel controller design for networks that are subject to constraints such as input saturation and delays. Other than these major topics, I will also briefly mention some tools that we have developed to support the above development of network design and control, e.g., the tools that address network-related numerical tasks such as distributed network partitioning and effective network simulation.

Speaker's Biography: Dr. Yan Wan is currently a postdoctoral fellow in the Institute for Collaborative Biotechnologies in the University of California, Santa Barbara. She received her Ph.D. degree in Electrical Engineering from Washington State University in 2008. She obtained her Bachelor's degree from Nanjing University of Aeronautics and Astronautics, China, and her Master's degree from the University of Alabama, Tuscaloosa. Her research interest lies in developing tools for design and control problems in modern dynamical networks, with applications in air traffic control, systems biology, and sensor networking. She is the author and coauthor of 39 publications, including 19 journal papers.