Control and Optimization in Complex Networked Systems: Algorithms and Applications

Prof. Manish Kumar
Cooperative Distributed Systems (CDS) Laboratory
Department of Mechanical, Industrial, and Manufacturing Engineering
The University of Toledo, Toledo, OH

Abstract:
Complex systems, describing a large number of social, biological, and engineered systems, are currently well recognized as an important paradigm in modern science and engineering. This talk will focus on swarm robotic systems, viewed as a class of complex systems, comprising a large number of robots in mutual, potentially nonlinear, interaction while exhibiting emergent group behavior. Of particular interest will be swarm systems in which mutual interactions are represented via pair-wise potentials. Examples of swarming behaviors inspired by different mechanisms such as ant colony systems and biological morphogenetic pattern formation will be discussed. Ongoing investigations on the synergistic influence of noise and nonlinearity on emergent behavior of swarm robotic systems will be presented using the example of ant foraging. A specific application of such systems in fighting wild-land fires, being pursued as a joint collaboration between the University of Toledo and University of Cincinnati, will be presented. Finally, the talk will briefly discuss some of ongoing projects at CDS lab in the area of optimization and control in complex systems.

Biography: Manish Kumar received his Bachelor of Technology degree in Mechanical Engineering from Indian Institute of Technology, Kharagpur, India, and his M.S. and Ph.D. degrees in Mechanical Engineering from Duke University, NC, USA. After finishing his Ph.D., he worked as a postdoctoral research associate at Duke University and as a National Research Council (NRC) postdoctoral Research Associate at the Army Research Office, NC, USA. As a part of his NRC Associateship program, he was a visiting scholar at General Robotics, Automation, Sensing, and Perception (GRASP) laboratory at the University of Pennsylvania, PA, USA. He served as a faculty member at the University of Cincinnati in the School of Dynamic Systems for five years. Currently, he is an Associate Professor in the Department of Mechanical, Industrial, and Manufacturing Engineering at the University of Toledo. He is the director of Cooperative Distributed Systems (CDS) Laboratory which focuses on research in the areas of robotics, optimization and control in complex systems, swarm systems, multiple robot coordination and control, intelligent modeling of uncertainties in sensor measurement, Unmanned Aerial Vehicles, and development of novel techniques to fuse data from multiple sources.

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Where: SSOE Seminar Room NI-1027