Mechanical Engineering Department Seminar

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10:40

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Transactive Control in Smart Cities

The concept of Smart City is gaining popular attention with the goal of sustainability and efficiency, the needs of enhancing quality and performance, and the explosion of technological advances in communication and computation. Given that 50% of the world's population lives in urban regions, critical infrastructures of energy, transportation, and health and their growing interdependencies have to be collectively analyzed and designed to provide the substrate for the realization of the Smart City Concept. This talk will address one of these infrastructures, Urban Mobility, and in particular the concept of dynamic toll pricing to alleviate congestion.

With the growth and expansion of many large metropolitan centers in the last few decades, the problem of traffic congestion continues to grow and vex commuters, commercial drivers, city planners and officials, and environmentalists worldwide. Over 1 billion vehicles travel on the roads today, and that number is projected to double by 2020. Driving a car is an unavoidable choice for at least 50% of city populations, who rely on their vehicles to get to school or to work. Transactive control, the concept of feedback through economic transactions, appears to be a promising tool for addressing traffic congestion. In particular, we have explored dynamic toll pricing for alleviating traffic congestion and increasing traffic flow during peak hours of the day. A model-based approach to dynamic toll pricing has been developed to provide a systematic method for determining optimal toll pricing schemes. Real-time traffic information from on-road sensors is integrated with complex models of driver behavior and traffic flow to determine the toll price, which acts as a controller to divert traffic flows to desired lanes and routes and lessen the traffic congestion experienced in certain areas. The overall idea of transactive control with particular illustrations of dynamic toll pricing will be presented in this talk.

Dr. Anuradha Annaswamy received her Ph.D. in Electrical Engineering from Yale University in 1985. She has been a member of the faculty at Yale, Boston University, and MIT where currently she is the director of the Active-Adaptive Control Laboratory and a Senior Research Scientist in the Department of Mechanical Engineering. Her research interests pertain to adaptive control theory and applications to aerospace, automotive, and propulsion systems, cyber physical systems science, and CPS applications to Smart Grids, Smart Cities, and Smart Infrastructures. She is the author of a hundred journal publications and numerous conference publications, co-author of a graduate textbook on adaptive control (2004), co-editor of two reports, IEEE Vision for Smart Grid Control: 2030 and Beyond," and Impact of Control Technology,(ieeecss.org/main/IoCT- report,ieeecss.org/general/IoCT2-report).

Dr. Annaswamy has received several awards including the George Axelby and Control Systems Magazine best paper awards from the IEEE Control Systems Society (CSS), the Presidential Young Investigator award from NSF, the Hans Fisher Senior Fellowship from the Institute for Advanced Study at the Technische Universität München, the Donald Groen Julius Prize from the Institute of Mechanical Engineers, a Distinguished Member Award, and a Distinguished Lecturer Award from IEEE CSS. Dr. Annaswamy is a Fellow of the IEEE and IFAC. She has served as the Vice President for Conference Activities (2014-15), and is currently serving as the VP for Technical Activities (2017-18) in the Executive Committee of the IEEE CSS.