Electrical & Computer ENGINEERING **SEMINAR**

Thursday, February 19
Scaife Hall Auditorium
Room 125
4:30 p.m.
Refreshments at 4:00 p.m.

Dr. Scott Bortoff
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Scott Bortoff is a Principle Research Engineer and Control Systems Group Leader at United Technologies Research Center (UTRC) in East Hartford, CT. He is responsible for technical capability in the areas of estimation and control algorithm design and implementation for the research project portfolio at UTRC. Dr. Bortoff's group conducts research and development of innovative control systems for energy-saving air conditioning and refrigeration systems, helicopters, fuel cell power plants and electric generation and distribution systems for aircraft. Previously Dr. Bortoff was an Associate Professor of Electrical and Computer Engineering at the University of Toronto, Canada, where he taught courses in controls and conducted research in nonlinear estimation and control, electric drives and robotics.

Dr. Bortoff holds advanced degrees in Electrical and Computer Engineering from the University of Illinois and Syracuse University.

Advances in Building Controls for Energy Efficiency

Commercial buildings currently account for 18% of US annual energy consumption, with energy use growing with square footage. **HVAC systems consume approximately 40% of that amount** depending on building type and geographic location. Because commercial buildings have lifecycles on spanning 50-100 years, reducing energy consumption in this sector is an urgent and important problem. The Department of Energy has set as an objective market-viable Net Zero Energy Buildings (NZEB) by 2025 and initial studies suggest that approximately 60% of the existing building stock can achieve that level of performance.

One of the key enabling technologies is building and especially **HVAC** control systems. Today building controls systems are designed largely to regulate process variables such as temperatures, pressures and flows to provide occupant comfort, with measures taken such as temperature set back to save energy during unoccupied periods. A common strategy is to decouple HVAC systems into manageable subsystems by regulating key process variables to a constant value. This simplifies operation and facilitates an equipment oriented design/build process but it tends to waste energy.

In this talk we present several results that show that the application of estimation and control theory to building **HVAC and security systems can improve building energy performance measurably**, and that these methodologies are in fact necessary to achieve the goal of **NZEBs**. In one example, a multivariable control algorithm applied to commercially available terminal units (fan coils) was shown to reduce building HVAC energy consumption by 12% with improved zonal comfort relative to commonly applied baseline technology. We also present some initial results for a DOE-sponsored demonstration of Model Predictive Control at the University of California Merced. Simulations indicate that a relatively basic MPC algorithm can reduce pump and chiller power consumption by approximately 10% with no change to building occupant comfort.

ECE Seminar Hosts

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