SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

NUMERICAL ALGORITHMS FOR PDE-CONSTRAINED OPTIMIZATION AND THEIR APPLICATION TO THE CONTROL OF HVAC SYSTEMS

Ph.D. Preliminary Research Examination

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Abstract: Heating, Ventilation, and Air Conditioning (HVAC) systems are complex mechanical devices designed to control the temperature and air flow within buildings. Standard HVAC systems typically use thermostats aiming to maintain a constant temperature in each room. However, the thermal comfort of occupants in the building depends on many other variables, such as humidity, air flow speed, clothing insulation, and personal metabolic rate. Moreover, even the most advanced control algorithms for HVAC systems used today are based on concentrated parameter dynamic models, which are not able to fully describe the effects that floor plans and inter-room air flow have to room temperatures.

Our research aims to use distributed-parameter computer fluid dynamic models, based on partial differential equations (PDE), to improve the efficiency of HVAC systems and directly control the thermal comfort of the occupants in a building. We developed a numerical optimization algorithm for control and estimation, using PDE adjoint equations and infinite imensional gradient descent principles. We applied our algorithm to control the temperature of small moving regions in a room, to reconstruct spatial temperature distributions, and to estimate the configuration of doors, all of these only using sensor data from a small number of thermostats. We also showed that our algorithm is more accurate and more memory efficient than current solutions found in the literature. We will study the use of model reduction methods to further improve the computation speed and resource efficiency of our algorithm.

DATE: Wednesday, August 31, 2016
TIME: 2:00 p.m.
PLACE: Green Hall, Room 0120

Dissertation advisor:
Dr. Humberto Gonzalez

This seminar is in partial fulfillment
of the Doctor of Philosophy degree

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