SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

A STATE SPACE ANALYSIS OF DOMINANT FEEDBACK LOOPS IN DYNAMIC SOCIAL SYSTEMS

Ph.D. Preliminary Research Examination

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Abstract: Many systems in the social sciences and non-engineering fields can be modeled as nonlinear dynamic systems, defined by ordinary differential equations. Because there is no general theory for closed-form solutions to nonlinear systems, researchers use simulation and structural dominance methods to understand how system structure determines behavior. Specifically, feedback loops within the system are examined experimentally and mathematically to understand how they give rise to certain behavior. There have been many ways proposed to measure the shifting of influence of feedback loops in a system, sometimes leading to conflicting insights about dominant system structure. Additionally, current loop dominance methods apply only to single state trajectories and do not address the entire state space of possible trajectories.

In engineering, state space methods are well-established for characterizing solutions to nonlinear dynamic systems and for controlling and regulating such systems. This research will explore the benefits of using state-space methods for analyzing social systems and examine the mathematical relationship between state-space and feedback loop dominance methods, with the goal of formalize an integrated approach.

This research aims to formalize a mathematical definition of feedback loop dominance and shifts in loop dominance. From this foundation, loop dominance and state space methods will be applied to a nonlinear dynamic model of the role of social determinants in obesity and population-level cancer outcomes supported by the Transdisciplinary Research on Energetics and Cancer (TREC) project. The aim will be to understand the extent to which these methods can be used in an integrated fashion to produce insights about influential feedback structure in the model. This research will explore possibilities for merging formal model analysis methods and nonlinear control theory to develop policy and intervention guidelines in the form of closed-loop feedback control.

DATE: Tuesday, May 5, 2015
TIME: 4:00 p.m.
PLACE: Green Hall, Room 0120

Dissertation advisors:
Dr. Joseph O'Sullivan
Dr. Peter Hovmand

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

Washington University in St. Louis
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