SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

MODIFYING SOCIAL BEHAVIOR AND POWER GRID STRUCTURES THROUGH GRAPH-THEORETIC ANALYSIS

DISSERTATION DEFENSE
By

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Abstract: In this presentation, we describe novel solutions to current problems in the electrical grid using modern mathematical tools, primarily graph-theoretic ones. Graph theory allows us to visualize information in novel ways, deriving novel insights. In the present work, we present graph-theoretic methodologies for constructing and managing power grids for reliability and efficiency.

To increase efficiency, we expand on our previous work in developing a method to influence social networks of smart grid users to encourage more conscientious usage of electricity. This method is based on the principle that the promotion of "good users" will naturally create more links from them in a social network. This in turn will cause good traits to diffuse through the network more naturally. We begin with an example of trying to convince users of a smart electrical grid to balance their loads throughout the day. This example is then generalized into a more abstract framework through which decision-making can be influenced. The successfulness of this method as a function of the parameters of the underlying decision-making problem is characterized.

For construction and reliability, we propose a novel combination of power failure metrics and financial risk tools to determine what configurations of an AC power transmission grid produce acceptably low risks of failure. We develop a framework that uses existing set-valued financial risk tools to generate an "acceptance set" based on criteria of performance. This framework allows us to test the acceptability over a wide variety of parameters without becoming too computationally intense. We consider the case of random failures in a power transmission grid. We empirically generate distributions of the amount of energy not served under these failures and analyze the tails of the distributions to generate a set of acceptable line capacities.

DATE: **Monday June 13, 2016**
TIME: **10:00 am**
PLACE: **Green Hall, Room 0120**

Dissertation advisor:
Dr. Arye Nehorai

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

Washington University in St. Louis
SCHOOL OF ENGINEERING & APPLIED SCIENCE