Electrical & Computer ENGINEERING

ENERGY AND INFORMATION SEMINAR

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Tues, Dec. 2

Porter Hall Room B34 at 12:30 p.m.

Malnoosh Alizadeh

Stanford University

Dealing with the High Dimensionality of Electric Load Control Problems

Mahnoosh Alizadeh is currently a postdoctoral scholar at Stanford University. She received her PhD degree in Electrical and Computer Engineering from University of California Davis in 2014 and her B.Sc. degree in Electrical Engineering from Sharif University of Technology in 2009. Her research interests are in analysis and design of intelligent cyber-human-physical infrastructures, with a specific focus on electric demand-side management problems.

Dealing with the High Dimensionality of Electric Load Control Problems

In this talk, I introduce the need for reduced-order modeling when a retailer is managing the electricity demand of a large population of end-users. I demonstrate the solutions we have proposed through an example focused on Electric Vehicles (EV). First, I introduce the concept of clustering load profiles that share similar degrees of freedom. I show that clustering allows us to develop hybrid state-space models that are scalable and can outperform the commonly used "load as a battery" approximation. The next part of the talk exploits these clustered load models to study optimal pricing mechanisms for recruiting heterogeneous customers in a program in which a retailer can directly manage their appliances' load. Lastly, the third part of the talk is dedicated to recent work on the decision problem of an EV owner who needs to plan a trip between an origin and a destination. This includes jointly deciding on a path and charging locations and associated charge amounts. At the system level, this joint planning for charge and path will introduce a connection between intelligent power and transportation systems. I will show that ignoring this connection and disjointly controlling these two cyber-human-physical systems in the presence of a large EV population can lead to instabilities in the power grid. Due to the enormous size of any control problem which considers both power and transportation networks, this solidifies our claim that we need reduced-order models that can correctly capture demand behavior with reasonable complexity.

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