

Electric Power and Power Electronics Institute

INVITED SEMINAR

Wednesday September 23, 2:30-3:30pm, WEB 236C (**Special Time**)

Data-Driven Modeling, Control and Tools for Cyber-Physical Energy Systems

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Abstract

Energy systems are experiencing a gradual but substantial change in moving away from being non-interactive and manually-controlled systems to utilizing tight integration of both cyber (computation, communications, and control) and physical representations guided by first principles, at all scales and levels. Control-oriented predictive models of an energy system's dynamics and energy consumption, are needed for understanding and improving the overall energy efficiency and operating costs. However, learning dynamical models using grey/white box approaches is very cost and time prohibitive since it often requires significant financial investments in retrofitting the system with several sensors and hiring domain experts for building the model.

In this talk, I will discuss the use of data-driven methods for making model capture easy and efficient for cyber-physical energy systems. This is done through, (a) reducing the need for sensor retrofits required for estimating the parameters of first principle based models, and (b) relying more on readily available data rather than domain experts for building control-oriented models.

I will present two methodologies, i) Model-IQ [<http://mlab.seas.upenn.edu/modeliq/>], which analyzes the end-to-end tradeoff between sensor placement, data quality, model accuracy and control performance using an uncertainty propagation algorithm; and ii) DR-Advisor [<http://mlab.seas.upenn.edu/dr-advisor/>], a recommender system for the buildings facilities manager which provides building power consumption prediction and control action recommendations for reliably meeting the required load curtailment and maximizing the economic reward.

Speakers Bio

Madhur Behl is a PhD candidate in Electrical and Systems Engineering at the University of Pennsylvania. His research focuses on problems of modeling, control, operation and implementation of Cyber-Physical Systems (CPS). He specializes in machine learning, real-time and embedded systems, control systems and automation, statistics and robotics. Applications of his work include data-driven and control-oriented modeling for energy-efficient building operation, model-based control design for peak power reduction and large scale demand response for buildings across a campus. Madhur is the winner of the best demo award at BuildSys, 2012 (International Conference on Embedded Systems For Energy-Efficient Built Environments). In 2011, he won the World Embedded Software Contest held in Seoul by the Korean Ministry of Knowledge Economy. He is also the recipient of the 2011 Richard K. Dentel Memorial Prize awarded by the University of Pennsylvania for research in urban transportation.