



## Predictive Control of Integrated Power Systems for Electrified Vehicles



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### Friday, September 25, 2015

3:30 – 4:30 pm • 1500 EECS

**ABSTRACT:** Integrated power systems (IPS) incorporate heterogeneous power sources, including energy storage systems, to achieve improved energy efficiency and reliability. They have been a critical enabling technology for vehicle electrification, as exemplified by their pervasive applications in hybrid electric vehicles and all electric ships. One special characteristic of IPS is the highly interactive and dynamic nature, due to tight physical couplings of the multiple components involved. To achieve high efficiency, one often needs to take advantage of knowing their operating profiles and pushing these systems to operate on or close to their admissible boundary, thereby calling for predictive control.

In this presentation, we will explore the special characteristics of the IPS and discuss the challenges and solutions of predictive control applied to this special class of systems. On the methodology side, we will present the integrated perturbation analysis and sequential quadratic programming (IPA-SQP) algorithm that was developed to deal with the fast and interactive dynamics of IPS. On the application side, we will cover several examples, including the IPS for all-electric ships and the integrated solid oxide fuel cell and gas turbine (SOFC/GT) system.

**BIO:** Jing Sun received the B.S. and M.S. degrees from the University of Science and Technology of China, Hefei, China, in 1982 and 1984, respectively, and the Ph.D. degree from the University of Southern California, Los Angeles, CA, USA, in 1989. After spending almost 10 years in the industry, she came back to academia and joined the faculty of the College of Engineering, University of Michigan, Ann Arbor, MI, USA, in 2003, where she is currently a Professor with the Department of Naval Architecture and Marine Engineering and the Department of Electrical Engineering and Computer Science. She has co-authored a textbook entitled Robust Adaptive Control, and holds 37 U.S. patents. Her current research interests include system and control theory and its applications to marine and automotive propulsion systems. Prof. Sun is one of the three recipients of the 2003 IEEE Control System Technology Award.