Ph.D. School in Electrical and Electronic Engineering and Computer Science

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Advanced Control for Complex Dynamical Systems

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Abstract:

Increased demands for high-performance and cost-effective operation necessitate advanced control of complex dynamical systems. The control objective is threefold: to support system safety and reliability, to reduce variability in product quality, and to increase system efficiency. The most widely used approach to advanced control of chemical and biological systems is *model predictive control* (MPC). The MPC framework enables handling of multivariable dynamics, system constraints, and competing sets of objectives in a systematic manner. However, the classical formulation of MPC is inherently limited to enable effective control of complex systems. The shortcoming primarily arises from (i) nonlinear system dynamics typically described by infinite-dimensional models, (ii) uncertainties and disturbances, which are ubiquitous in complex systems, (iii) high interactions between the different subsystems of a system, which often make decentralized control inadequate, (iv) sensor limitations in accurately measuring the system state variables, and (v) degradation of the control performance due to system faults and component failures. This talk aims to address the aforementioned challenges in advanced control of chemical and biological systems. Extensions of the classical MPC formulation will be presented to deal with nonlinear dynamics, system uncertainties, system-wide control, and fault-tolerant control of complex dynamical systems.

Biography:

Dr. Ali Mesbah is currently a senior postdoctoral associate in the Department of Chemical Engineering at the Massachusetts Institute of Technology. He recieved his Ph.D. degree from Delft Center for Systems and Control at Delft University of Technology (The Netherlands). Dr. Mesbah's research lies at the intersection of systems and control, applied mathematics, and process systems engineering. His primary research interests include first-principles/data-driven modeling and model predictive control of uncertain, nonlinear dynamical systems, with applications in large-scale process systems and continuous manufacturing systems. Dr. Mesbah will join the faculty of the Department of Chemical and Biomolecular Engineering at the University of California, Berkeley in July 2014.

Organizer

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Seminar in English.

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