Electrical & Computer ENGINEERING

SEMINAR

DISTINGUISHED LECTURE

THURSDAY
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REFRESHMENTS: 4 P.M.

Manfred Morari

AUTOMATIC CONTROL LABORATORY AT ETH ZURICH

Manfred Morari was appointed head of the Automatic Control Laboratory at ETH Zurich in 1994. Before that he was the McCollum-Corcoran Professor of Chemical Engineering and Executive Officer for Control and Dynamical Systems at the California Institute of Technology. He obtained the diploma from ETH Zurich and the Ph.D. from the University of Minnesota, both in chemical engineering. His interests are in hybrid systems and the control of biomedical systems. In recognition of his research contributions, he received numerous awards, among them the Donald P. Eckman Award and the John Ragazzini Award of the Automatic Control Council, the Allan P. Colburn Award and the Professional Progress Award of the AIChE, the Curtis W. McGraw Research Award of the ASEE, Doctor Honoris Causa from Babes-Bolyai University, Fellow of IEEE, the IEEE Control Systems (Technical Field) Award, and was elected to the National Academy of Engineering (U.S.). Professor Morari has held appointments with Exxon and ICI plc and serves on the technical advisory board of several major corporations.

Control of Hybrid Systems: Theory, Computation and Applications

Theory, computation and applications define the evolution of the field of control. This premise is illustrated with the emerging area of hybrid systems, which can be viewed, loosely speaking, as dynamical systems with switches. Many practical problems can be formulated in the hybrid system framework. Power electronics are hybrid systems by their very nature, systems with hard bounds and/or friction can be described in this manner and problems from other domains, as diverse as driver assistance systems, anesthesia and active vibration control can be put in this form.

I will describe the theoretical basis of some of the tools that have been proposed to synthesize the controllers for hybrid systems. Parametric programming has received a lot of attention in the control literature in the past few years because model predictive controllers (MPC) can be posed in a parametric framework and hence pre-solved offline, resulting in a significant decrease in on-line computation effort. I will describe recent work on parametric linear programming (pLP) from the point of view of the control engineer. I will survey various types of algorithms, and identify a new standard convex hull approach that offers significant potential for approximation of pLPs for the purpose of control. The resulting algorithm, based on the beneath/beyond paradigm, computes low-complexity approximate controllers that guarantee stability and feasibility.

Many industrial applications will serve to highlight the theoretical developments and the extensive software that helps to bring the theory to bear on the practical examples.

Joint work with Colin Jones, Miroslav Baric and Melanie Zeilinger

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