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Interpolation-based control for polytopically constrained linear, time-varying or uncertain, discrete-time dynamical systems

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Abstract:

A fundamental problem in automatic control is the control of uncertain plants with control constraints and with state or output constraints. Most elegantly, and theoretically most satisfying, the problem is solved by optimal control which, however, rarely gives a feedback solution, and oftentimes only a numerical solution. Therefore, in practice, the problem has seen many ad-hoc solutions, such as "over-ride control", and "antireset windup". Another solution, pioneered by Propoi (1964) that has become popular during the last decades is "Model Predictive Control" (MPC) where an optimal control problem is solved in every sampling instant, and the excerpt of the control vector meant for the nearest sampling interval is applied. In spite of the increased computational power of control computers, MPC is at present mainly suitable for low-order, well-known, linear systems. The robust version of MPC is conservative and computationally complicated, while the "explicit" version of MPC that gives an affine state feedback solution involves a very complicated division of the state-space into polyhedral cells. In this presentation an elegant, and computationally cheap solution is presented for linear, time-varying or uncertain, discrete-time systems with polytopically bounded control and state (or output) vectors, with bounded disturbances.

Biography:

Prof. Gutman is with the Technion from 1989 - Israel Institute of Technology, holding, since 2007 the position of Professor at the Faculty of Civil and Environmental Engineering. Gutman was a visiting professor with Laboratoire d'Automatique, ENSIEG, Grenoble, France in 1995-96, spent most summers 1990-2008 as a visiting professor at the Division of Optimization and Systems Theory, Department of Mathematics, Royal Institute of Technology, Stockholm, Sweden, was a visiting professor with Universit à del Sannio, Benevento, Italy, 2005-2006, and a researcher at the Commissariat a l'énergie atomique CEA-LIST DIASI/Interactive Robotics Laboratory, Fontenay-aux-Roses, outside Paris, France, in 2009-2010. His research interests include robust and adaptive control, control of complex non-linear systems, computer aided design, vehicle control, including autonomous vehicle control, and traffic control. He invented the Vertex Control control method (with M. Cwikel), and its extension Interpolating Control (with Hoai-Nam Nguyen, Sorin Olaru, and Morten Hovd).