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Flexible Control Lyapunov Functions

A central tool in systems theory for synthesizing control laws that achieve stability are control Lyapunov functions (CLFs). Classically, a CLF enforces that the closed-loop trajectory is contained within a cone with a fixed, predefined shape, and which is centered at and converges to a desired converging point. However, such a requirement often proves to be over conservative. This research deals with the generalization and relaxation of classical CLF design for discrete-time systems. Rather than searching for globally defined CLFs off-line, the focus is on synthesizing CLFs by solving on-line an optimization problem. As a result, it is possible to derive a trajectory-dependent CLF, which is allowed to be locally non-monotone.

The talk will cover to some extent the following areas of research: (i) design of flexible CLFs for discrete-time nonlinear systems; (ii) stabilization of nonlinear hybrid systems by trajectory-dependent CLFs; (iii) optimized input-to-state stabilization; (iv) decentralized control using structured CLFs.

Brief information about the speaker: Dr. M. Lazar

- PhD from the Technical University of Eindhoven, September 2006: “Model predictive control of hybrid systems: Stability and robustness” - “Best thesis in Europe on Networked and Embedded Control” EECI-HYCON award for the period 2006-2007.
- Outstanding reviewer of IEEE Transactions on Automatic Control, 2003, 2004, 2005.
- VENI grant (personal grant for excellence in research) from the Netherlands Organization for Scientific Research (NWO), 2008 – 2011.
- IPC committees: 3rd IFAC Conference on Analysis and Design of Hybrid Systems, 2009; 48th IEEE Conference on Decision and Control, 2009.
- Organizer of the 4th International Workshop on Future Directions and Assessment of Nonlinear Model Predictive Control, 2011.