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Trajectory Exploration for Aggressive Maneuvering

Prof. John Hauser
University of Colorado at Boulder

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Laboratorio Automatica Edificio Stecca

About the speaker

John Hauser received the BS degree from the United States Air Force Academy and the MS and PhD degrees from the University of California at Berkeley, all in Electrical Engineering and Computer Science. Between his periods of education, he flew Air Force jets throughout the United States and Canada participating in active Air Defense exercises. In 1989, he joined the Department of EE-Systems at the University of Southern California as the Fred OGreen Assistant Professor of Engineering. Since 1992, he has been at the University of Colorado at Boulder in the Department of Electrical, Computer, and Energy Engineering. He has held visiting positions at many places including University of Padova, Caltech, Instituto Superior Tecnico in Lisbon, Lund Institute of Technology, and Ecole Superieure dElectricite. He received the Presidential Young Investigator award from the National Science Foundation in 1991.

John Hausers research interests include nonlinear dynamics and control, optimization and optimal control, aggressive maneuvering for high performance motorcycles and aircraft and other vehicles, and dynamic visualization. Recent work has focused on the development of optimization (and optimal control) tools and techniques for trajectory exploration with an eye toward characterizing the trajectory space (with limitations) of highly maneuverable nonlinear systems. This work finds application in the control of highly configurable UAVs (with propulsion vectoring) and in the analysis of racing motorcycles.

Abstract

What do aggressive trajectories of high performance motorcycles, race cars, and aircraft really look like? How can we explore the space of system trajectories? How do complex dynamics and constraints restrict system capabilities and performance?

How might we go about trajectory exploration and optimization? Given a state-control trajectory of a nonlinear system, one may make use of a simple (e.g., linear time-varying) trajectory tracking control law to explore the set of nearby trajectories. Such a trajectory tracking control system defines a nonlinear projection operator that maps a set of bounded curves onto a set of nearby trajectories. We will show how one may use such a projection operator to develop descent methods (e.g., Newton's method) for the optimization of trajectory functionals (also known as optimal control).

Contact

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