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Lyapunov Functions, Point Stabilization, and Strictification

by
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Friday, October 7, 2011
3:30 – 4:30p.m
Rm. 1500 EECS

Abstract: Constructing strict Lyapunov functions is a central and challenging problem in nonlinear control theory. In many practical situations, non-strict Lyapunov functions can be constructed easily, using passivity, backstepping, or forwarding, or by taking the Hamiltonian for Euler-Lagrange systems. Roughly speaking, non-strict Lyapunov functions are characterized by having negative semi-definite time derivatives along all trajectories of the system, while strict Lyapunov functions have negative definite derivatives along the trajectories. Even when we know a system to be globally asymptotically stable, it is often still important to have an explicit global strict Lyapunov function, e.g., to design feedbacks that give input-to-state stability to actuator errors. This has motivated a significant body of research on ways to explicitly construct strict Lyapunov functions. This talk will present an overview of the strictification approach and an important biologically inspired example involving Lotka-Volterra systems.

Biosketch:. Michael Malisoff received his Ph.D. in 2000 from the Department of Mathematics at Rutgers University in New Brunswick, NJ. After completing his doctoral studies in optimal control and Hamilton-Jacobi theory, he worked as a DARPA Research Associate in the Department of Systems Science and Mathematics at Washington University in Saint Louis, as part of the Joint Force Air Component Commander project. In 2001, Dr. Malisoff joined the faculty of the Department of Mathematics at Louisiana State University in Baton Rouge where he is currently an associate professor. Dr. Malisoff's main research has been the development of constructive Lyapunov-based methods for nonlinear control systems with uncertainty and their applications in marine robotics and aerospace and mechanical engineering. His many awards included two three-year National Science Foundation Mathematical Sciences Priority Area grants, and he is an associate editor for the journals Automatica, Systems and Control Letters, and IEEE Transactions on Automatic Control.

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