ECE Graduate Seminar Series:

Curve Tracking for Marine Robots: A Case Study in Feedback Control

(2:00-2:50PM, 2/21/2014, EB 2.04.02)

Curve tracking is important for the effective navigation of mobile robots in complex environments. For curve tracking in the plane, the curve tracking dynamics can be simplified to a system of two ordinary differential equations with one control. However, even for the simple case of one robot tracking a curve in the plane, curve tracking can be challenging, because of collision avoidance constraints, disturbances acting on the system, imperfect information about the current state of the system, and unknown control gains. In this talk, we will discuss the two-dimensional curve tracking problem in detail and explain how to overcome some of these challenges, using adaptive control, Lyapunov functionals, and robust forward invariance. Then we will explain how we used our controller in field work at the Louisiana coast, to control marine robots that were used to track pollution from the Deepwater Horizon oil spill disaster. This talk will be understandable to students who are familiar with basic control systems. It is based on the speaker's joint work with Professor Fumin Zhang from the Georgia Tech School of Electrical and Computer Engineering and with several students.

Michael Malisoff, Ph.D.

Michael Malisoff earned his PhD in mathematics in 2000 from Rutgers University in New Brunswick, NJ. In 2000, he joined Washington University in St. Louis as a DARPA Research Associate. In 2001, he joined the faculty of the Department of Mathematics at Louisiana State University in Baton Rouge, where he is now the Roy Paul Daniels Professor #3 in the LSU College of Science. His current research is on nonlinear control under delays and uncertainty. He has also worked with engineering faculty on control problems for active magnetic bearings, adaptive systems, bioreactors, brushless DC motors, heart rate controls, microelectromechanical relays, neuromuscular electrical stimulation, and unmanned air vehicles. His 90 publications include a Springer monograph on constructive Lyapunov methods. His awards include the First Place Student Best Paper Award at the 1999 IEEE Conference on Decision and Control, two 3-year National Science Foundation Mathematical Sciences Priority Area grants, and 6 Best Presentation awards in American Control Conference sessions. He is an associate editor for IEEE Transactions on Automatic Control and for SIAM Journal on Control and Optimization.