Collective Dynamics and Control Lab

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Topics

Nonlinear dynamics and control: *Cooperative control of autonomous vehicles in the air and sea*
Mobile sensor networks: *Optimal and adaptive sampling of spatiotemporal processes*
Biocomplexity: *Quantitative modeling of animal groups and grouping behavior*

Projects

Dynamics and Control of Motion Coordination for Information Transmission in Groups (NSF CAREER)
To improve understanding of collective behavior in biological groups and to improve capacity to model and synthesize collective motion in engineered networks.

Synthetic Collective Unmanned Underwater Laboratory (ARMY/OSD)
To address test and evaluation gaps in unmanned autonomous systems by (1) using model-based simulation on reduced-order models and (2) developing and testing bio-inspired micro-UUVs.

Optical Flow and Electroreception for Underwater Motion Coordination and Homing (ONR)
To demonstrate the feasibility of applying bio-inspired optical and electric sensing and Bayesian data fusion to the problem of multi-vehicle survey/surveillance and single-vehicle mine neutralization.

**Targeting Observations of Hurricanes using Cooperative Control of Unmanned Aircraft (NSF CMMI)**
To combine numerical-modeling methods from atmospheric science with feedback-control methods from nonlinear control theory to synthesize novel observing strategies that use a coordinated fleet of unmanned aircraft.

Autonomous Motion Coordination of Unmanned Naval Platforms in a Dynamic Flowfield (ONR)
To apply tools from nonlinear science, including dynamical systems theory and nonlinear dynamics, to promote autonomy in unmanned Naval platforms and to provide greater situational awareness to Naval operations.

Undergraduate projects
To develop an operator interface application for the iPhone and iPad devices to control teams of robots, inexpensive exciting tools for educational purposes such as Sea Perch recovery system.
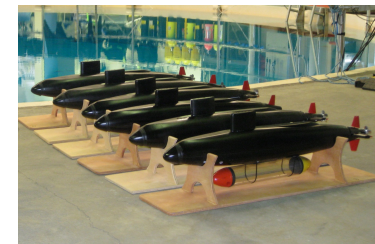
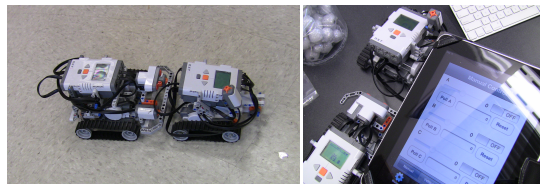Synthetic Collective Unmanned Underwater Laboratory (SCUUL)

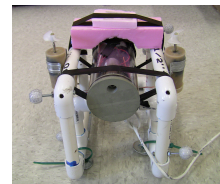A swarm of micro-helicopters capable of cooperative behavior

Tracking of fish schooling for 3D reconsrtuction

iRobot Create following a line

iPad control of Lego NXT Robots

Sea Perch underwater robot