

Course: EW485B Control of Multi-Agent Networks

Credits: 3 credits – 2 recitation hours – 2 laboratory hours

Course Description: Recent technological advances in electronics, computing, and wireless communications have enabled the use of multiple autonomous networked agents in a wide range of commercial, military, and scientific applications. Nowadays, multi-agent systems are employed for surveillance, force protection, environmental sampling, power distribution, and smart building management, among many other tasks. This course will focus on the control and coordination of cooperative multi-agent systems with special emphasis in networks of mobile robots.

Pre-requisites: None

Course Coordinator: Assoc. Prof. Erick Rodriguez-Seda

Textbook: *Graph Theoretic Methods in Multiagent Networks*, by Mehran Mesbahi and Magnus Egerstedt, 2010

Course Objectives: This course is designed to provide students with an introduction to the control and coordination of multi-agent systems. At the completion of the course, the student will be able to:

- Understand the control and communication challenges that multi-agent systems face
- Understand and apply fundamental concepts and tools on graph theory and stability
- Design and evaluate consensus control algorithms for multi-agent systems
- Design and evaluate cooperative control laws for multiple mobile robot networks for formation control, collision avoidance, coverage control, and other areas of robotics
- Design control laws that are robust to communication challenges such as delays, limited information, and cyber attacks

Topics:

- Intro to multi-agent networks
- Graph theory basics
- Connectivity
- Consensus (Static)
- Lyapunov stability
- Potential Field Methods
- Mobile Robots: Formation Control
- Mobile Robots: Navigation
- Mobile Robots: Collision Avoidance
- Mobile Sensors: Coverage Control
- Communication Challenges

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