EE631 Syllabus (Spring 2012)

Catalog Description: EE631: Cooperating Autonomous Mobile Robots

Advanced topics in autonomous and intelligent mobile robots, with emphasis on planning algorithms and cooperative control. Robot kinematics, path and motion planning, formation strategies, cooperative rules and behaviors. The application of cooperative control spans from natural phenomena of groupings such as fish schools, bird flocks, deer herds, to engineering systems such as mobile sensing networks, vehicle platoon.

Credit: 3.

Prerequisites:

This course does not assume any prior knowledge of robotics. However, the course does assume a working knowledge of calculus, discrete math, matrix algebra, probability, and the ability to program in Matlab, C or C++.

Textbook:

None. Reference books and a selection of research papers will be provided.

Reference books:

1. R. Siegwart and I. Nourbakhsh, Introduction to Autonomous Mobile Robots, MIT Press, 2004. Website: http://autonomousmobilerobots.epfl.ch/
2. J-C. Latombe, *Robot Motion Planning*, Kluwer Academic Publishers, 1991.
3. S.M. LaValle, *Planning Algorithms*, Cambridge University Press, 2006. Available at http://msl.cs.uiuc.edu/planning/
4. J.-P. Laumond, *Robot Motion Planning and Control*, Springer-Verlag, London, 1998. Available at http://www.laas.fr/~jpl/book-toc.html
5. Zhihua Qu, Cooperative Control of Dynamical Systems: Applications to Autonomous Vehicles, Springer, 2009.

Instructor:

Yi Guo, Associate Professor of ECE
Office: Burchard 202, Phone: (201) 216-5658, Email: yguo1@stevens.edu
Office Hours: Tuesday Wednesday 3pm-4pm, and by appointment

Goals:

The course introduces advanced topics in autonomous and intelligent mobile robots. It is designed to develop fundamental understanding of planning and control issues for

Schedule of Topics (tentative):

Week	Date	Topic
1	17-Jan	Introduction to autonomous mobile robots
2	24-Jan	Introduction to multi-robot systems.
3	31-Jan	Path planning algorithms, A* and D* algorithms
4	7-Feb	Multi-robot motion planning algorithm.
5	14-Feb	Kinematic models of robotic vehicles, steering methods
6	21-Feb	No class. Monday class schedule.
7	28-Feb	Collision avoidance in dynamic environments
8	6-Mar	Cooperative control of large-scale systems
9	13-Mar	No class. Spring recess.
10	20-Mar	Review of linear control theory and algebraic graph theory
11	27-Mar	Multi-agent consensus protocol.
12	3-Apr	Multi-vehicle formation control
13	10-Apr	In-class presentation #1
14	17-Apr	In-class presentation #2
15	24-Apr	Special topic
16	1-May	Course wrap-up, Final project consultation