CSCI-4965/6963: Robot Motion Planning
Fall 2001

1 Course Information

Instructor:	Srinivas Akella
Email:	`sakella@cs.rpi.edu`
Office:	Amos Eaton 112, x8770
Office hours:	Tuesday 2:30-3:30pm

Lectures:	Monday, Thursday 2:00pm–3:50pm
Classroom:	Sage 2715
Credits:	4 (undergraduates)/ 3 (graduate students)
Prerequisites:	Data structures and algorithms (CSCI-2300), Multivariable calculus and matrix algebra (MATH-2010), or permission of instructor.

Course web page: Course announcements and information will be available at
`http://www.cs.rpi.edu/~sakella/rmp`

Textbook:
Robot Motion Planning by J.-C. Latombe, Kluwer, 1991.
We will supplement the textbook with additional readings for better coverage of the course topics and to reflect recent work in the area.

2 Course Overview

This course is an introduction to algorithmic techniques for robot motion planning. Topics will include configuration space representations, roadmap methods, cell decomposition and potential field techniques, randomized path planning, collision detection, multiple robot coordination, nonholonomic motion planning, and manipulation planning. We will motivate these techniques by applications of motion planning to mobile robots and robot manipulators, assembly planning, computer aided design, and computer graphics.

Prerequisites: This course does not require a prior background in robotics. Prerequisites for the course are Data Structures and Algorithms (CSCI-2300) and familiarity with Calculus and Matrix Algebra (MATH-2010). Students should be interested in geometrical concepts and algorithms, and have good programming skills. Knowledge of C++ and Unix will be helpful for the programming assignments.

3 Syllabus

This is the tentative sequence of topics to be covered.

1. Introduction to Robot Motion Planning (Chapter 1)
2. Geometric transformations and Configuration space representations (Chapters 2 and 3)
3. Roadmap methods (Chapter 4)
4. Cell decomposition (Chapter 5)
5. Potential field techniques (Chapter 7)
6. Collision detection (supplemental papers)
7. Probabilistic techniques (Chapter 7, supplemental papers)
8. Multiple robot coordination (Chapter 8)
9. Nonholonomic motion planning (Chapter 9)
10. Articulated robots (Chapter 8)
11. Manipulation planning (Chapter 11, supplemental papers)
12. Advanced topics and new directions (supplemental papers)

4 Grading

The course activities consist of homework assignments, a midterm exam, and a final course project (or a final exam, as discussed in class). Students taking the graduate version of the course (CSCI-6963) will also be required to make a classroom presentation on a topic to be selected with the instructor. There will be four or five homework assignments, which will be a combination of written homeworks, reading reports on research papers, and programming assignments. The final course project will be an implementation of a motion planning algorithm. In addition to a demonstration and presentation of the project, students must submit a written summary of the project. Projects are to be done individually.

Undergraduate students and graduate students will be graded separately. The tentative grading scheme for the course is as follows:

CSCI-4965
Homework assignments: 50%
Class participation: 5%
Midterm exam: 15%
Course project (or Final exam): 30%

CSCI-6963
Homework assignments: 45%
Midterm exam: 15%
Class presentation: 10%
Course project (or Final exam): 30%

Attendance Policy: Attendance in class is expected and students are responsible for knowing all material covered in class. A portion of the grade for students taking the undergraduate version of the course (CSCI-4965) will determined by class attendance and participation.

Lateness Policy: Assignments turned in up to 24 hours after the due date will receive a 10% penalty. After that, late assignments are subject to a 20% penalty and will be accepted for a week after the deadline or until solutions are posted.

If there is a good reason you will need an extension on an assignment, contact me **in advance**. Each student may be given up to two days (whole or partial) of extension over the semester for late assignments. Use these late days carefully. Once you have exhausted these days, **no excuses will be accepted** without a written letter from the Dean of Students' office. This includes late days for illnesses, plant trips, etc.

5 Academic Honesty

Students are encouraged to discuss class material and homework assignments. However they are expected to write their homeworks individually and submit their own work for assignments and projects. In particular, it is inappropriate for students to share code or write code together for programming assignments or projects.

A student found cheating on an assignment or project will receive a zero for it. Copying or using disallowed materials during an exam is cheating, of course, and will result in a zero on the exam. A repeat offender will receive a fail grade for the course and will be reported to the Dean of Students office.

Refer to the Rensselaer Handbook, which defines various forms of academic dishonesty. Students found in violation of academic honesty policies will receive a failing grade for the course.