1 Course Objective

The course objective is to introduce the students to the principles of robotics. In particular, the course will start from simple problems in transformations, kinematics and inverse kinematics, dynamics, and control. Later in the semester, more complex problems in sensing, force control, mobile robots, and robot programming will be discussed.

Upon successful completion of the course, the student must be able to:

- Understand the difficulties of robotics.
- Apply the principles of geometry to derive models for the forward and inverse kinematics of a manipulator.
- Understand the dynamics of a manipulator.
- Implement several simple robot control laws.
- Appreciate the computational complexity of these algorithms.
- Understand the various sensing techniques.
- Understand the real-time control and programming issues.
- Understand the principles of operation for mobile robots.
2 Topics Covered

The course will cover the following topics:

- Transformations.
- Kinematics.
- Inverse kinematics.
- Jacobians.
- Dynamics.
- Trajectory generation.
- Robot control.
- Force control.
- Sensing.
- Robot programming.
- Mobile robots.

3 Textbook


4 Additional References (Not Required)


5 Web Resources


6 Grading

The grade of the course will consist of the following components:

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<tr>
<th>Component</th>
<th>Percentage</th>
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<tr>
<td>Homeworks</td>
<td>45%</td>
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<tr>
<td>Exam (11/19/15)</td>
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<tr>
<td>Project</td>
<td>30%</td>
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<td>Project Presentation</td>
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7 Homeworks

Three homeworks will be given during the semester. They will consist of problems that will help you understand the material and monitor your progress. Homeworks are due ten days after the hand-out day. Solutions to the homeworks will be distributed. One of the homeworks may be a programming assignment in which case, you will have three weeks to work on it.

8 Exam

The exam will test your understanding of some of the basic concepts taught in the class.

9 Project

One of the most important components of this class is the final project. Projects may take the following forms (you can work in groups of two or three if you want):

- Literature survey (with critical evaluation) on a given topic.
- Theoretical work.
- Simulation or experiments.

The project should not be limited to a plain literature survey. It should be a substantial piece of work that addresses issues beyond those covered in class. Moreover, you should stop by my office and discuss your topic with me. If you choose to do experimental work, you may use the robots (Pioneers, etc.) of the AI, Robotics, and Computer Vision Laboratory of the Computer Science Department or the robots in the Undergraduate Robotics Laboratory.

All the students should give a short presentation of their project towards the last weeks of the semester. This presentation will count for 5% of the total class grade.
The project schedule is:

October 8: Initial report. One or two pages explaining the project with a list of references.
November 10: Partial report.
December 15: Final report (15 to 30 pages).

10 Cheating and Plagiarism

The homeworks must not be the result of cooperative work. Each student must work individually in order to understand the material in depth. You may discuss the issues but by no means, copy the homework of somebody else. All work in the projects must properly cite sources. For example, if you quote a source in your project, you must include the quotation in quotation marks and clearly indicate the source of the quotation. Any student caught cheating will receive an “F” as a class grade and the University policies for cheating and plagiarism will be followed.

11 Syllabus

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<th>Topic</th>
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