
EML 6805
ADVANCED DESIGN OF ROBOTS
Spring 2012

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www.eng.fiu.edu/mme/robotics

Course Description:

Kinematic analysis of mechanisms and robot arms, analytical and numerical methods to address robot kinematics. Robotic arm and mobile platform design including a review of major design components such as actuators, sensors, and controllers. Computer-based design, analysis and project assignment.

Prerequisite:

EML 3222, EML 3262 and EML 4501 or permission of the instructor.

Lectures:

Lectures: R 11:00 am – 1:45 pm, EC 1112.

Office Hours:

R 3:30 – 5:00 pm. For other times, appointment by e-mail is encouraged.

Text Book:

No formal textbook will be required. Handouts will be provided at the course website as necessary.

Course Outline:

1. Introduction to robotic systems
2. Review of industrial robots and mobile platform architectures
3. Kinematic analysis of mechanisms and robot manipulators
4. Analytical and numerical methods to study robot kinematics
5. Humanoid robots
6. Microcontroller programming

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7. Components in robot design, actuators and sensors
 8. Structural design
 9. Controllers and system interface
 10. Control software

Course Objectives:

1. Design of multi degree-of-freedom robots and mobile platforms.
2. Review of the latest technology available to design robotic systems.
3. Use of professional engineering tools to design robots.
4. Programming of microcontrollers to control a robotic system.
5. Literature review on robot design.
6. Hands-on experience to design a robotic system.

Learning Outcomes:

Students will be able to design a robot starting with the conceptual design, develop the concept into a model, analyze the model on computer using engineering software packages, complete the structural design, and be able to build a prototype, present results in terms of a PowerPoint presentation, develop an engineering report and demonstrate the robot's performance.

Academic Learning Compact (ALC) Supported by the Course:

Academic Learning Compact (ALC) items that are supported by this course are as follows:

- (ALC 1) Ability to apply knowledge of mathematics including statistics, multivariable calculus and differential equations, science including physics, and engineering.
- (ALC 3) Ability to design a system, component, or process to meet desired needs.
- (ALC 4) Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.
- (ALC 5) Ability to function on multi-disciplinary teams.
- (ALC 9) Knowledge of contemporary issues.
- (ALC Critical Thinking 1) Ability to identify, formulate and solve engineering problems.
- (ALC Oral & Written Communication 1) Ability to communicate effectively.

Note Regarding ALC Items:

Academic Learning Compact (ALC) items are defined for the MME program that must be achieved by graduating students. Each course supports several of the ALC components incrementally but must not necessarily achieve them fully.

Grading:

<u>Activity</u>	<u>Percent</u>
Attendance	10%
Quizzes & Assignments	15%
Midterm Exam	15%
Project 1	15%
Project 2	15%
Project 3	15%
Project 4	15%

Project 1: Individual project on kinematic/structural design of a multi-DOF robot or mobile platform. Identification of topic for Project 4.

Project 2: Team-based robot programming and in-class presentation.

Project 3: Team-based robot design, construction, programming, testing, and in-class demonstration. Project 3 will require each team to make several presentations on the progress of work as well as written progress reports. The final report will be written professionally in the form of a technical paper for possible submission to a technical conference.

Project 4: Research paper developed individually.

Note on team projects: Each presentation, progress report and final report is required to clearly demonstrate the contribution of each team member. This requires division of responsibilities clearly ahead of time. Team members should be flexible to take on additional responsibilities and help another member when necessary.

Correspondence via E-mail:

Each student is required to provide a reliable e-mail address for correspondence. Announcements and reminders will be sent via e-mail throughout the semester. Students are expected to check their e-mail regularly and make sure their inboxes are not full as the bounced mail messages will not be sent again.

Late Projects:

Project due dates will be strictly enforced. Late project submissions will not receive full credit, and the following policy will apply: Submissions after the class hour on due date or the following day will lose 10 points out of 100. Submissions on the second or third day after the due date will lose 10 additional points each day.

Quizzes:

Unannounced quizzes based on material covered will be given throughout the semester. No make-ups will be offered for quizzes, as it is extremely impractical to do so. The lowest quiz grade will be dropped. If you miss classes more than once, be prepared to miss a quiz and receive a “0” grade as a result.

Ethics:

All work prepared and submitted in this course in the form of projects, presentations, problem solutions in quizzes and exams are expected to be original and produced by the submitting student. Any portion that may have been borrowed from a previous work must be clearly identified and referenced to indicate the original author along with the title of the work, and where and when it appeared. The origin of each figure, photograph, table as well as text used from other sources must be clearly identified.

It is extremely important to realize that not doing so may result in an accusation of plagiarism.

Projects must contain the following statement and include student’s signature:

Author’s Ethics Statement:

The work submitted in this project is solely prepared by NAME LASTNAME, and it is original. Excerpts from others’ work have been clearly identified and listed in the list of references. All of the engineering drawings, computer programs, formulations and related files submitted on the accompanying CD are also original and prepared by NAME LASTNAME.

NAME LASTNAME (Include all team member names for team projects)

(Include Signature. Every team member must sign the statement)

Plagiarism Prevention at Turnitin.com:

Final versions of project reports will be submitted to www.turnitin.com to be evaluated against plagiarism.

The site compares the submitted document for similarities against the works published by others and assigns a similarity index. Lower similarity percentages (0 to 10%) indicate less similarity and are interpreted as good. Higher percentages mean that plagiarism is likely and your report grade will be adversely affected.

For projects that are individually assigned, each student is required to submit his/her final version of every report to www.turnitin.com. If the similarity index is too high, you can edit your report and upload it again before the project submission deadline. This will give you a chance to improve your similarity index.

For team-based projects, each team is required to upload its report by one team member since multiple entries of the same report result in very bad similarity indices for later submissions. In order to improve the similarity index, the same team member will be permitted to resubmit the revised report before the deadline expires.

You can submit your reports to www.turnitin.com by using the following information:

Course ID: 3133018

Course ID: Robotics2

Policy on Incomplete Grades:

A grade of “incomplete” will not be assigned to replace an unwanted grade. In order to be eligible to receive “incomplete,” only a single component of the entire coursework needs to be missing, and the reason for the missing component must be verified in writing – such as a letter from a medical doctor.

The University requires that a student must fill out an “Incomplete Grade Form” before the incomplete grade is assigned. The form must be signed by both the student and the professor, and copies provided to the Chair as well as the Dean’s office. Otherwise, an incomplete grade will not be assigned.