ME586 Mechanics and Control of Robotic Manipulators
Department of Mechanical, Aerospace and Biomedical Engineering
University of Tennessee-Knoxville
Fall 2007

Instructor: Dongjun Lee
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Class Schedule: TR 11:10am-12:25pm @ 104 Humanity & Social Sciences Building
(close to McClung Plaza/Hodges Library)

Office Hours: 2:00pm-4:00pm R or by appointment

Course Website: http://web.utk.edu/~djlee/ME586.htm

Course Description: This is a first graduate level course on robotics. In this course, we mean mainly by a robotic system a mechanical system consisting of interconnected multiple rigid bodies with actuation situated at some of junctions between them. Main topics of this course are 1) rigid body motion description; 2) relation between joint-angle and position/angle of end-effector (i.e. kinematics); 3) dynamics; and 4) some important control techniques for such robotic systems. For this course, students are assumed to have working knowledge of the courses ME231, Math251 and ME363 at UTK or the equivalent elsewhere, although necessary mathematical/technical backgrounds will also be briefly covered before using them in the course. MatLab and SimuLink would be necessary for the homework and also for the final project. So, students are encouraged to get to know this important engineering tool individually. A good starting point would be http://www.engin.umich.edu/group/ctm. No formal instructions on Matlab/SimuLink will be given in the course.

Grading: Homework (50%) Midterm Exam (20%) Final Project (30%)
Tentatively, Midterm Exam is scheduled on 10/23/07 during the class time
and the due date of the submission of the Final Project is 4:30pm 12/10/07

Textbook: Spong, Hutchinson & Vidyasagar, Robot Modeling and Control, John Wiley & Sons, 2005

References:

[1] Methods of Applied Mathematics, Hilderbrand, Dover 1992
- to quickly brush the subject of linear algebra

[2] Linear Algebra and its Applications, Strang, Academic Press, 1980
- a standard undergraduate-level linear algebra textbook

[3] A mathematical Introduction to Robotic Manipulation, Murray, Li and Sastry, CRC Press, 1994
- more advanced textbook on robot kinematics, dynamics, and controls.

[4] Applied Nonlinear Control, Slotine and Li, Prentice-Hall, 1991
- easy to read nonlinear control text

Final Project: The objective of this final project is for students to have a chance to apply all the learned concepts/topics in this course to a mock-up problem, which would contain some important aspects of real-world robot control applications. Students are supposed to work individually for this project. Students are also supposed to write a project report containing relevant derivations and numerical/experimental results.

Course Outline (tentative)
1. introduction (0.5wk)
2. linear algebra essentials (1wk)
3. rigid body motion description (2wk)
4. forward/inverse kinematics (1.5wk)
5. Jacobian (2wk)
6. path planning (as time permits 1.5wk)
7. dynamics and structural properties of robotic systems (2.5wk)
8. motion control (2wk)

Late Submission Policy: Homework is due before or at the beginning of the class on the same date. If you submit your assignment (including the final project report) after the due time but still within 2 hours, you will have 20% point deduction of the full point. Submission after this time but still on the same date will have 50% deduction of the full score. If you submit your assignment on the next day of the due date or later, you will get zero point, so don't do that.

Student Conduct Standards: Students are expected to perform this course with a high academic standard, honesty, and integrity. More precisely, you are expected and required to follow the University's Honor Statement, which can be found in the Hiltopics, the student handbook*: "An essential feature of the University of Tennessee is a commitment to maintaining an atmosphere of intellectual integrity and academic honesty. As a student of the University, I pledge that I will neither knowingly give nor receive any inappropriate assistance in academic work, thus affirming my own personal commitment to honor and integrity".* Any academic dishonesty found in this course will lead to "F"-grade of the course as well as his/her case will be reported to an Academic Review Board by notifying the administrative head, the department head, and the Office of the Dean of Students. This is also very important and imperative for your success in your professional career. So, please don't do any academically inappropriate conduct which you think (or are not sure) may lead into this unfortunate circumstance. For other student conduct policy, again, refer to the Hiltopics.

Students with Disabilities: The Office of Disability Services (ODS) assists students with disabilities in eliminating barriers so that they may have access to all the academic, social, cultural, and recreational opportunities of the University. To have this service, you need to contact the ODS: 2227 Dunford Hall, 915 Volunteer Blvd, 964-6087 (v/tty) or ods@utk.edu. For more details, refer to the Hiltopics or contact the ODS.