University of Alaska Fairbanks
Electrical and Computer Engineering Department
EE693 – Robot Modeling and Control
Fall 2011
REVISED (received 5/16/2011, jbh)

SYLLABUS AND COURSE INFORMATION

Lecture Time: TR (5:15-6:45 PM) **Room:TBA**

Catalog Description:

Introduction to basic concepts in robotics; homogeneous transformations; Denavit-Hartenberg parameters, forward and inverse kinematics; velocity kinematics, Jacobiens; dynamics and modeling; robot control: independent joint control, multivariable control, Lyapunov stability, PD+, computed torque, inverse dynamics control with the use of Matlab/Simulink, kinematics and control related demonstrations on the PUMA 560 manipulator.

Prerequisites: EE471 or equivalent in control; PHYS F211X/F212 or equivalent

Text: Introduction to Robotics: Mechanics and Control, Craig, 3rd edition, Pearson Prentice Hall, 2005

Instructor: Seta Bogosyan **Office:** Duckering 221
Telephone: 474-2755 **e-mail:** sbogosyan@alaska.edu

Office Hours:

Wed : 1:00- 4:00 PM; or by appointment.

COURSE POLICIES

Point Distribution:		
	Midterm I	**20%**
	Midterm II	**20%**
	Final Exam	**25%**
	Quizzes	**10%**
	Homework& Project	**15%**
	Class Performance	**10%**
	Total	**100%**

A >= 93%; A- 90%; B+ 87%; B 80%; B- 77%; C+ 73%; C 70%; C- 67%; D 60%; F. No +/- grades for D.

Assessment Criteria:

- ➔ No late homework will be accepted unless previously authorized by the instructor. Work should be done on an individual basis.
- ➔ Students are expected to know Matlab/Simulink software as prerequisite to this course.
- ➔ Two 60 minute midterms will be administered during the semester.
- ➔ One 2-hour final will be administered at the end of the semester.
- ➔ Regular class attendance is strongly recommended and participation in class by asking relevant questions and answering the instructor's questions will be graded by the above mentioned percentage.
- ➔ Tests will be open/close book at the instructor's discretion.
- ➔ Plagiarism in tests and assignments may lead to an automatic fail in this class.
- ➔ Make-up exams may be administered based on the instructor's discretion and only with officially documented excuses.

➔ There will be a course project that uses MATLAB/SIMULINK. Students are expected to present their project work and results in the form of a technical report. The students can use the computer facilities at SOECAL, and at DU 530-532.

DETAILED COURSE TOPICS:

Week 1,2	Introduction to robotics; basic concepts; homogeneous transformations
Week 3	Transformations cont'd; forward kinematics
Week 4	Denavit-Hartenberg parameters
Week 5	Inverse kinematics
Week 6	Velocity kinematics
Week 7	Jacobiens and force/torque relationships
Week 8	MIDTERM I
Week 9	Dynamics; Euler-Lagrange method
Week 10	Independent joint control of robots
Week 11	Review and MIDTERM II
Week 12	IJC cont'd; introduction to Lyapunov stability theory
Week 13	Multivariable control
Week 14	Feedforward control; PD+
Week 15	Inverse dynamics control
Week 16	FINAL (TBA)

Learning outcomes: With robots used as examples throughout, the students will see tangible applications for some material learned in past physics and mechanics, such as what is actually meant by inertia, spring and damper effects, practical meaning of rotation and transformation matrices and equation of motion. This is the only course in ECE (or maybe at CEM) that uses SIMULINK predominantly as an experiment tool, providing sufficient expertise in its use. This is again the only course at ECE, and maybe at CEM that introduces students to the control of nonlinear systems and problems for which the standard linear control solutions studied in the undergraduate Fundamentals of Automatic Control course would not work. This is the only course at CEM that addresses different aspects of motion control providing the student with a more practical understanding for the need of closed loop control (with the inevitable disturbance effects created by the robot arm). The student will have a much better understanding of these highly theoretical concepts after taking this course.

Disabilities Services: The Office of Disability Services implements the Americans with Disabilities Act (ADA), and insures that UAF students have equal access to the campus and course materials. I will work with the Office of Disabilities Services (203 WHIT, 474-5655) to provide reasonable accommodations to students with disabilities. (http://www.uaf.edu/disability/).