

CS 470X, CpE 470X

Advanced Robotics

Department of Computer Science and Engineering

University of Bridgeport

Spring 1999

Catalog Data:

Advanced robotics and automation topics and techniques, including: active robotic sensing, intelligent and integrated manufacturing systems, robotic inspection, observation under uncertainty, multisensor feedback control of manipulators and mobile robots, advanced simulation and monitoring of robotic systems, high level modeling and control, and other topics.

Prerequisites: Introduction to Robotics (CS 360X, CpE 360X, CS 460X, or CpE 460X), and Preferably CS 309, CS 404, or CpE 404 (AI) or permission of instructor.

3 lecture hours, 3 semester hours.

Textbooks:

Selected readings, technical publications, and research papers and reviews. To be distributed in class. (No formal text book)

References:

Craig, John J., "Introduction to Robotics Mechanics and Control", Addison Wesley Publishing Company.

J. P. Norton, "Introduction to Identification", Academic Press Inc.

Mark W. Spong and M. Vidyasagar, "Robot Dynamics and Control", John Wiley & Sons.

Coordinator:

Tarek M. Sobh, Ph.D., P.E.

Associate Professor of Computer Science and Engineering

Director of External Engineering Programs

Room: 256 Dana Hall, Tel: 576-4116

e-mail: sobh@bridgeport.edu

Web: <http://www.bridgeport.edu/~sobh> Web: <http://www.bridgeport.edu/~risc>

Goals:

This course is an introduction to advanced topics and research areas in robotics and automation (R & A). The students will be familiarized with issues, research projects, and industrial techniques and applications in the following areas: Active and passive sensing in R & A, industrial inspection, hybrid control and high-level modeling, control, simulation, and monitoring of automated manufacturing, autonomous, tele-autonomous, and semi-autonomous systems.

Prerequisites by Topic :

Ability to program in C, Unix, data structures and algorithms, general computer organization and architecture, PC interfacing, PC programming and windows, advanced calculus and analytic geometry, and linear algebra. Preferably some control theory background. Basic Robotics, including: position and velocity sensing, actuators, robot coordinate systems, robot kinematics, differential motions, path control, dynamics, and force control. Robot sensing, simulation of manipulators, automation, and robot programming languages.

Meeting Times and Place:

Tuesday 1:00 – 2:30
Thursday 5:00 - 6:00
Robotics Lab.

Office Hours:

Tuesday 2:30 – 4:00
Wednesday 2:00 – 3:30
Dana 256
Or by appointment.

Topics and Dates:

- Introduction to Research Topics in Robotics, Automation, Sensing, and Manufacturing. (2 weeks)
- Advanced Robotic Programming, Simulation, Monitoring, and Control. (1 weeks)
- Robot Sensory Systems. (1 week)
- Motion in 3-D and Structure for Manipulator and Mobile Systems. (1 week)
- Hybrid and Discrete Event Control of Automated Systems. (1 week)
- Industrial Inspection of Parts and Objects. (1 week)
- Reverse Engineering of Mechanical Parts. (1 week)
- Robot and Manipulator Prototyping and Design Optimization. (1 week)
- Sensing Under Uncertainty (Modeling and Recovery). (1 week)
- High level Tele-autonomous Control Hierarchies for Mobile and Fixed Robots. (1 week)
- Reachable Workspace Problems for Complete and Redundant Manipulators. (1 week)
- Tolerancing for Manufacturing Sensed Objects. (1 week)

Policies and Grading:

Grade Calculation:

- Quizzes and Participation: 10%
- Homeworks (Written Homeworks and Programming assignments): 30 %
- Laboratory Projects (Large Machine Assignments): 60%

Policies:

- Late homeworks and projects will not be accepted.
- Three or more unexcused absences will result in an automatic failure.
- Make-up exams or quizzes will not be allowed (except for prior instructor approval for a documented emergency)
- Homeworks and programs are due within a week from the assignment date, unless the instructor notes otherwise.
- All homeworks are to be typed.
- Structured and modular code is required for the machine assignments.
- All programs are to include sufficient comments and documentation with a clear program statement.
- Programs are to be submitted with all I/O files and source code hardcopies.
- Extra credit quizzes, assignments, and programs (if any) will be announced by the instructor.
- The instructor will discard the worst (lowest score) one or two quizzes for each student at the end of the class (they will not be counted towards calculation of the final grade).