

Massachusetts Institute of Technology  
Department of Mechanical Engineering

## **2.017 Design of Electromechanical Robotic Systems**

### **INTRODUCTION AND SHORT SYLLABUS**

3-4-5, ½ Lab credit

Instructor: Prof. Franz S. Hover, [hover@mit.edu](mailto:hover@mit.edu) , 3-6762

Pre-requisites: 2.003

Co-requisites: 2.671 and 2.005 or 2.016

This subject will be given in Spring 2008. After this, it will be given in the fall term, including Fall 2008.

#### **NEW STATUS**

Course 2 students: 2.017 can now be taken in place of, or in addition to, 2.007 Design and Manufacturing I. If both are taken, one would be a core subject and the other a restricted elective.

Course 2-A students: 2.017 can be taken as a restricted elective or as one of the “Three of Five” core list.

Course 2-OE students: 2.017 is a required core subject.

Most students will take the subject in their junior year.

#### **Lecture Topics** (3 hours per week)

1. Introduction and Linear Systems: Properties and Examples; Convolution and the Fourier Transform
2. Spectra: Properties and Tools; Applications
3. Probability and Random Variables
4. Long- and Short-Term Statistics
5. Operation in a Random Environment: Speed Effects and Sea-Keeping in Marine Vessels
6. System Design: Concepts of the Process; Tools and Applications
7. Optimization: Varieties of Problems and Solutions; Dynamic and Linear Programming
8. Machine Elements: Gears and Bearings; Mechanical Linkages
9. Overview of Experiments, Data, Testing, and Presentations
10. Simulation in Design: Monte Carlo Techniques; Quadrature Techniques
11. Navigation Systems: Absolute Reference; Relative Reference
12. Physics of Underwater Acoustics
13. Feedback: The Connection with Uncertainty: Models and Disturbances; Selected Topics in Control Implementation; Discrete-Time Signals and Control
14. Engineering Ethics: Overview and Case Studies

#### **Lab Overview** (4 hours per week)

Weeks 1-4: Formal labs to acquaint you with the laboratory, and our instrumentation and systems. Embedded computing, C and Matlab, data acquisition, serial communications, motion control. Students work in pairs.

Weeks 5-8: State a hypothesis concerning a physical quantity that has natural variability; design and build an experiment to collect data. Write a short report on your findings. Students work in pairs.

Weeks 9-14: Design a real electromechanical robotic system to operate in the field and complete a given mission, as posed by the instructors. Write a short report on your success. Students work in teams of four to six.

**No Quizzes or Exams. Homework is assigned every two weeks.**

*Marine-robotics flavored projects from 2.017 in prior years: the ROV Tetragonos picking up a jack, a Flettner-rotor sailboat, a resonant-mass wave energy converter, and an acoustic-homing autonomous kayak.*

