ME451: Control Systems Fall 2009

Instructor: Prof. Dongjun Lee  office) DO502  e-mail) djlee@utk.edu  phone) 865-974-5309

Lectures: MWF 10:10am-11:00am @ Dougherty 601

Companion website: http://www.prenhall.com/dorf

Prerequisite: ME363 System Dynamics or consent of instructor

Office hours: M 1-2pm and F 1-3pm (or by appointment)

Grading: Homeworks: 10%
Quizzes: 10%
Final project: 10%
2 Mid-term exams: each 20%
Final exam: 30%

Synopsis: Control technology (i.e. make a system to behave as we want) is one of the key enabling technologies for many important systems: from the 18th century James Watt’s flyball governor to today’s automobile, hard disk drives, printers, factory robots, satellites, autopilot, autonomous vehicles/robots (e.g. Roomba!), insulin pumps, to name just a few. From this course, students will learn how to analyze and design linear control systems using the tools/concepts of Laplace, frequency, and state-variable techniques.

Outline of topics:
1. Introduction (Ch. 1)
2. Physical system modeling and Laplace transform (Ch. 2 - Sec.2.7)
3. Feedback control characteristics (Ch. 4 - Sec. 4.3)
4. Feedback control performance (Ch. 5 - Sec. 5.7/5.8)
5. Stability in Laplace domain: Routh-Hurwitz stability criterion (Ch. 6 - Sec. 6.4)
6. Root-locus method (Ch. 7 - Sec. 7.5/7.6)
7. Frequency response: Bode plot (Ch. 8)
8. Stability in frequency domain: Nyquist method (Ch. 9 - Sec. 9.5)
9. Feedback control system design (Ch. 10 - Sec.10.9/10.11)
10. State variable models (Ch. 3 - Sec.3.4/3.5 + Sec.6.4: as time permits)
11. State variable feedback design (Sec.11.1/11.2/11.3: as time permits)
Other important course information:

1. Two in-class mid-term exams will be given. For the first exam (9/25/09), you will be allowed 1 letter-size two-sided paper; for the second exam (11/2/09), 2 such papers. Otherwise, closed-book/note.

2. Final exam will be 10:15am-12:15pm, Friday 12/09/09. It will be comprehensive and closed-book/note. You will be allowed 2 letter-size two-sided papers.

3. Homework will be graded 0/0.25/0.5/0.75/1 from 0-1 scale. Homework should be turned in at the beginning of the lecture on the due date. If turned in late on the same day, 50% will be deduced. Otherwise, it will get zero point.

4. Short quizzes will be given from time to time.

5. Final project will be a team project (3-4 people/each team). More details will be TBA.

6. Attendance is required. More than 5 unjustified missing classes will result in F grade.

7. Grading scale: A 30%, B 40%, C-F 30%. This can be changed according to students’ performance

8. Computer usage: MatLab, SimuLink and control system toolbox will be necessary for this course. These software are available for CoE students.

9. Students are expected to behave professionally in this class: going-in/out during the class, newspaper reading, or other unprofessional behaviors (e.g. what you would haven’t done in high school) will not be allowed.

10. Any academic dishonesty found in this course may lead to F-grade and academic disciplinary actions.

University’s Honor Statement: “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”.

Students with Disabilities: The Office of Disability Services (ODS) assists students with disabilities. To have this service, contact the ODS: 2227 Dunford Hall, 915 Volunteer Blvd, 964-6087 (v/tty) or ods@utk.edu. For more details, see the Hilitopics or contact the ODS.