ECSE-4510: Digital Control Systems
SPRING 2015

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Credit hours: 3

Classroom: JEC 4104/ Tuesday, Friday; 2:00pm – 3:20pm


Prerequisites: ECSE 2410 (Signal and Systems) or equivalent. Familiarity with MATLAB.

Website: RPI LMS

Course Content:
Sampling, quantization, and reconstruction of signals. Mathematical tools used in the modeling, analysis, and synthesis of discrete-time control systems. Analysis tools include z-transforms, difference equation solutions, state variables, and transfer function techniques. Design tools include digital PID controller, root locus, bilinear transformations, compensation techniques and full-state feedback. Applications to sampled-data control. In this course, some computation tasks will be done with MATLAB.

Learning Outcomes:
Students are expected to achieve the following upon completion of the course
• understand the concept and use of z-transform and difference equations in discrete-time system analysis
• understand the concept and use of mathematical tools for discrete-time controller design
• build and analyze models and design feedback controls in MATLAB that achieve design requirements
Grading:  
Homework  20%  8-10 assignments  
Midterm I:  20%  March 17, in class  
Midterm II  20%  May 8, in class  
Final exam: TBD  30%  TBD  
Class project  10%  Same as final exam  

Homework: All homework sets are due in class, one week after the handout/posting date, unless specified otherwise. No late homework will be accepted. Two of the lowest homework grades will be excluded from the final grade. Collaboration in the solution of the homework problems is permitted, but the work you turn in must be your own. Mere copying of the solution from another student is not allowed. Please be sure to have your solutions clearly and neatly written to receive full credit.

Exams: There will be two midterm exams. The final exam will be held during the final exam period. The exam dates are fixed. There will be no makeup exams. Please avoid scheduling interviews or trips on these dates. Both midterm and final exams will be closed book, closed notes. No computer, calculator, cell phone, Internet access are allowed in the exams. One handwritten letter size sheet (double-sided) is permitted.

Project: Class project may be performed by teams of at most 2 students. You are free to choose your partner. Individual work is also allowed. The project will require a written report. A signed statement describing the respective contribution is required as part of the final project report for groups of two.

Homework and project may require the use of MATLAB and Simulink.

Attendance: Attendance is not compulsory. However, every student registered for this class is subject to the same requirements and grading policy, regardless of attendance.

Statement of academic integrity:  
Student-teacher relationships are built on trust. For example, students must trust that teachers have made appropriate decisions about the structure and content of the courses they teach, and teachers must trust that the assignments that students turn in are their own. Acts, which violate this trust, undermine the educational process. The Rensselaer Handbook of Student Rights and Responsibilities define various forms of Academic Dishonesty and you should make yourself familiar with these. In this class, all homework assignments and exams turned in for a grade must represent the student’s own work. You are allowed to work together for the homework. However, the writing must be your own (copying is not acceptable). One instance of unacceptable collaboration or plagiarism will result in 0 point for the work. A second instance of academic dishonesty will result in failure of the course. The student may also enter the Institute judicial process and be subject to such additional sanctions as: warning, probation, suspension, expulsion, and alternative actions as defined in the current Handbook of Student Rights and Responsibilities. If you have any question concerning this policy before submitting an assignment, please ask for clarification. Cell phone usage including texting of any kind during and exam will be considered cheating, and will result in a zero for the exam.

Course Coverage:  
1. z-transform (Chapter 2)  
2. Sampling and reconstruction (Chapter 3)  
3. Open-loop and Closed-loop systems (Chapter 4, 5)  
4. System response characteristics (Chapter 6)  
5. Stability analysis techniques (Chapter 7)  
6. Digital controller design (Chapter 8)  
7. Other topics