ECE-520 Discrete-Time Control Systems
Winter 2009

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Recommended Text: Class Notes

GRADING POLICY

Each Exam	15%
Labs	35%
Homework/Matlab/Simulink	20%

Notes:

1. You must acceptably complete each lab to pass the class. Each lab is due on Monday at noon the week after the lab is assigned. It may be turned in one week late for a maximum of 50% credit, and after that there is no credit. If you have an excused absence (such as a plant trip or illness) contact me in advance if possible.

2. Homework turned in one week after the due date will receive a maximum of 50% credit. After one week late the homework will receive no credit. If you have an excused absence contact me in advance if possible.

3. For the majority of the labs, you will be required in the preceding homework to derive some relationships we will be using in lab or simulate a system (or systems). If you understand the homework the lab should not be a problem.

4. Many of the homework problems will require you to use Matlab or Simulink as part of the problem. If you do not do these parts of the problem, do not expect to receive credit for any parts of the problem.

5. Most of the homework problems will have you show something or derive something. For the most part it should be clear to you if you understand the problem. It is your responsibility to understand each problem and come and ask for help if you do not understand the material. ***Homework solutions will not be posted or given out.***

6. You are expected to do your own work. You can certainly talk with each other and help each other, but the work you hand in should be your own. As an example, if two people hand in the same Simulink plot and both came from the same directory, neither will receive any points!

7. Unless specifically told otherwise on a particular problem, you are expected to work out the problem by hand (or use Matlab). *If you write on your assignment that you used Maple and are copying the answer, expect to get no points.* You can use Maple to check your answers. You cannot turn in any Maple code or plot as part of the solution to a problem.

Labs:

1. You must work individually for the labs.

2. Labs can be done at your convenience as long as they are turned in on time. You do not have to do them during the assigned lab time, but you should look at the schedule for room usage.

3. You must write a short memo summarizing your results. You should include **as attachments** in the memo the plots and you made for the lab. The lab write up is generally to be computer generated and each graph needs to be labeled as a figure (with a caption). Usually students find it easier to just copy and paste all the figures they need into a document and explain the figure or answer questions as they are doing the lab.

4. Your labs are 35% of your grade, so do a good job. Each graph should be associated with a Figure number and caption, and the axes should be appropriately labeled where appropriate.

5. The systems in the lab use Matlab 2008. This is the first time this course has been taught with this version of the software. If the system does not run as long as you would like, you may have to try to run it a few times.

Tentative Schedule

11/30 Discrete-time functions
No Lab
12/1 Discrete-time convolution
12/3 z-transforms

12/7 Inverse z-transforms
Lab 1: System identification in the continuous domain (2 1 dof systems)
12/8 Solving difference equations, Asymptotic stability, Settling Time
12/10 Sampling plants with zero order holds

12/14 Discrete-time state variable models
Lab 2: System identification in the continuous domain (2 2 dof systems)
12/15 Computing the state transition matrix, exp(At)
12/17 Discrete-time state variable descriptions with delays

1/4 Transfer functions from state equations
Lab 3: Discrete-Time PID Controllers
1/5 Linear Algebra Review
1/7 ***Exam 1***

1/11 Cayley-Hamilton Theorem, controllability, observability
Lab 4: Discrete-Time I-PD and PI-D Controllers
1/12 State variable feedback-Ackermann's Formula
1/14 State variable feedback-Eigenvalue Assignment

1/18 State variable feedback-Eigenvalue Assignment
Lab 5: State variable feedback
1/19 Integral Control
1/21 Integral Control

1/25 Full order observers
Lab 6: State feedback with integral control
1/26 Full order observers
1/28 ***Exam 2***

2/1 Minimum order observers
Lab 7: Full order observers with/without integral control
2/2 Minimum order observers
2/4 Transfer function of observer based controllers

2/8 Vector Calculus, Lagrange Multipliers
Lab 8: Minimum order observers with/without integral control
2/9 Quadratic optimal control
2/11 Quadratic optimal control

2/15 Quadratic optimal control
Lab 9: Inverted pendulum control
2/16 Quadratic optimal control
2/18 ***Exam 3***