ECE-520 Discrete-Time Control Systems
Winter 2008

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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 Friday at noon the week after the lab is assigned to be completed. 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.

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 6.5.1. You can either do all of your problems in the lab or load Matlab 6.5.1 on your laptops. If you modify the Simulink models with a different version of Matlab, you may not be able to utilize them on the systems (Matlab 6.5.1 may not be able to read the files.)

Tentative Schedule

12/1 Discrete-time functions
12/2 Discrete-time convolution
12/4 z-transforms
No Lab

12/8 Inverse z-transforms
12/9 Solving difference equations, Asymptotic stability, Settling Time
12/11 Sampling plants with zero order holds
Lab 1: System identification in the continuous domain (2 1 dof systems)

12/15 Discrete-time state variable models
12/16 Computing the state transition matrix, exp(At)
12/18 Discrete-time state variable descriptions with delays
Lab 2: System identification in the continuous domain (2 2 dof systems)

1/5 Transfer functions from state equations
1/6 Linear Algebra Review
1/8 ***Exam 1***
Lab 3: Discrete-Time PID Controllers

1/12 Cayley-Hamilton Theorem, controllability, observability
1/13 State variable feedback-Ackermann's Formula
1/15 State variable feedback-Eigenvalue Assignment
Lab 4: Discrete-Time I-PD and PI-D Controllers

1/19 State variable feedback-Eigenvalue Assignment
1/20 Integral Control
1/22 Integral Control
Lab 5: State variable feedback

1/26 Full order observers
1/27 Full order observers
1/29 ***Exam 2***
Lab 6: State feedback with integral control

2/2 Minimum order observers
2/3 Minimum order observers
2/5 Transfer function of observer based controllers
Lab 7: Full order observers with/without integral control

2/9 Vector Calculus, Lagrange Multipliers
2/10 Quadratic optimal control
2/12 Quadratic optimal control
Lab 8: Minimum order observers with/without integral control

2/16 Quadratic optimal control
2/17 Quadratic optimal control
Lab 9: Inverted pendulum control
2/19 ***Exam 3***