ECE-420 Discrete-Time Control Systems
Fall 2014

Dr. Bob Throne   x-8414, Room C-206   Recommended Text: Class Notes

GRADING POLICY

Each Exam	20%
Homework/Matlab/Simulink	20%
Project	20%

Notes:

1. 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.

2. 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.***

3. 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!

4. 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 unless you are explicitly told you can as part of the problem.

Project:

We are going to have a sequence of weekly miniprojects that will hopefully help you understand how you might implement a discrete-time adaptive controller using a recursive least squares algorithm to estimate the plant parameters and an adaptive controller to design a new controller as the plant is changing. We will use both transfer function and state variable approaches. You will be given a new piece of the project every week. We will be using both Simulink (the embedded system toolbox) and Matlab for this project. *You may work in pairs on these assignments, as long as you tell me who worked together.*

Tentative Schedule

9/4 Discrete-time functions
9/5 Discrete-time convolution

9/8 z-transforms
9/9 Inverse z-transforms
9/11 Complex conjugate poles
9/12 Solving difference equations, Asymptotic stability, Settling Time

9/15 Sampling plants with zero order holds
9/16 Transfer function control
9/18 Placing closed loop poles
9/19 Placing closed loop poles

9/22Vector calculus
9/23 Lagrange multipliers
9/25 Least squares problems
9/26 ***Exam 1***

9/29 Singular value decomposition (svd)
10/30 Recursive least squares
10/2 Recursive least squares
10/3 Adaptive control

10/6 Discrete-time state variable models
10/7 Computing the state transition matrix, exp(At)
10/9 *No Class*
10/10 *No Class*

10/13 Discrete-time state variable descriptions with delays
10/14 Transfer functions from state equations
10/16 Cayley-Hamilton Theorem, controllability, observability
10/17 State variable feedback-Ackermann's Formula

10/20 State variable feedback-Eigenvalue Assignment
10/21 State variable feedback-Eigenvalue Assignment
10/23 State variable feedback-Eigenvalue Assignment
10/24 ***Exam 2***

10/27 *No Class*
10/28 *No Class*
10/30 Integral Control
10/31 Integral Control

11/3 Full order observers
11/4 Minimum order observers
11/6 Minimum order observers
11/7 Minimum order observers

10/10 Quadratic optimal control
10/11 Quadratic optimal control
11/13 Quadratic optimal control
11/14 Make-up day