ChEE 413
Spring 2005
University of Arizona

Instructor: Dr. Paul Blowers
128 Harshbarger, 626-5319
blowers@engr.arizona.edu
Office Hours:To Be Determined

Lecture: ECE 102, TR, 930 - 1045 am
Lab: To be announced

TA: Paul Safier, psafier@u.arizona.edu Office Hours: To Be Determined

Course Description:

This course will introduce you to the fundamental principles of automatic process control, which is a method of maintaining process variables at desired values. Processes are dynamic in nature with interrelated variables constantly changing. Because these variables are closely related to safety, product quality, production rates, etc., efficient process control is very important. We will use simple models of the dynamics of chemical processes to illustrate the design of control systems. Empirical techniques for tuning feedback and feed forward controllers will be discussed as well as advanced control methods.

Text: *Process Dynamics and Control*, D. E. Seeborg, T. F. Edgar, and D. A. Mellichamp, John Wiley and Sons, 1989.

Course Policy:

Homework, quizzes, and labs (20 % of grade)
Homework is due at the beginning of the class on the day it is due. Late homework will not be accepted.

Exams (two exams, 20 % each, 40 % of grade total)
In-class exams are scheduled for Tue 2/22 and Tue 4/12.
Unless otherwise announced, these exams will be closed book.

Make-up exams: A make up exam may be arranged if you notify the instructor before the regularly scheduled exam. A makeup exam will be scheduled only if the student has a valid reason for missing the regularly scheduled exam. Verifiable illness with notification from the emergency dean or family emergencies are valid reasons for missing an exam.

Final exam: (40 % of grade). Comprehensive final on Thursday 5/12, 8am-10 am. A comprehensive final will be given during the scheduled period during finals.

Course Objectives

At the end of this semester you will be able to:

1) Develop differential equation models to describe many types of chemical processes.

2) Use LaPlace transforms to convert a differential equation into an algebraic one.

3) Solve the differential equations in the LaPlace domain.

4) Bring a LaPlace domain solution back into the time domain.

5) Create transfer functions to describe the time-dependent behavior of representative processes.

6) Quickly identify and sketch time-dependent outputs for inputs to transfer functions.

7) Use poles and roots to describe the time dependent stability and response for systems.

8) Use approximate methods to find system parameters from output data.

9) Create a feedback control loop to stabilize a process.

10) Make a block diagram for a process.

11) Use closed loop and open loop responses to evaluate process stability.

12) Be able to reduce a complicated block diagram down to a simpler form.

13) Describe and implement proportional only control, integral control, derivative control and various combinations of them.

14) Use amplitude ratios and phase margins to design controllers to stabilize a system.

15) Identify weaknesses in your own knowledge-base so you can use a feedback process to become a lifelong learner.

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Class Schedule:

Date	Reading Assigned	Homework Problems	Date Due
1/13	Pg 1-15		1-25
1/18	Pg 16-27	Homework Set 1	1-25
1/20	Pg 27-43		2-1
1/25	Pg 51-69	Homework Set 2	2-1
1/27	Pg 78-103		2-8
2/1		Homework Set 3	2-8
2/3			2-15
2/8	Pg 103-147	Homework Set 4	2-15
2/10			2-22
2/15	Pg 147-176	Homework Set 5	2-22
2/17			
2/22	Exam 1		
2/24	Pg 183-199	Homework Set 6	3-3
3/1	Pg 200-232		3-3
3/3		Homework Set 7	3-10
3/8	Pg 232-259		3-24
3/10	Pg 259-286	Homework Set 8	3-24
3/15	Spring Break	no class	
3/17	Spring Break	no class	
3/22		Homework Set 9	3-29
3/24			
3/29	Pg 286-334	Homework Set 10	4-5
3/31	Pg 334-357		
4/5			
4/7	Pg 358-380	Homework Set 11	4-14
4/12	Exam 2		
4/14			4-21
4/19	Pg 388-404	Homework Set 12	4-21
4/21			
4/26	Pg 411-441	Homework Set 13	5-3
4/28			
5/3	Last Day of Classes		
5/10	Final Exam 8am - 10 am		

The last day to drop courses with a W is on March 8th.

Standards for Homework Problems and Quizzes:

1. Briefly restate the problem using a sketch or diagram where appropriate. Label the sketch or diagram with all quantities involved.

2. Indicate the basis you select, and indicate any change of basis within the problem. State assumptions.

3. Include both the numerical value and units for all quantities involved, including intermediate results.

4. Answers should be circled or otherwise marked, and reported to an appropriate number of significant digits.

5. Values obtained from a handbook or other reference should be accompanied by a citation. For example:

CCl_4 boiling pt. 76.5 ^{o}C (CRC, pg C-373)

6. Show how you have checked your work if appropriate.

7. Be clear and concise when writing answers to questions.

Standards for Style and Presentation of Problem Sets

1. All assignments are to be submitted on 8.5 x 11 inch paper with writing on one side only. Multiple pages must be stapled together. Unlined paper may be used if the work is done neatly. Handwriting must be legible.

2. Each page must have the student's name, the course number and the page number in the upper right hand corner.

Substandard work will result in a loss of credit.