

155: 422

Process Simulation & Control

Fall 2017

Webpage: Sakai (<https://sakai.rutgers.edu/portal>)

Lectures: Tue, Thu, 3.20 to 4.40PM, Hill 114

Instructor: Dr. Rohit Ramachandran

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Office hours: **Thu 445PM-630PM**

Location : TBD

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Course Description:

This course is an introductory description of the basic fundamental principles of automatic control of processes of general interest to chemical engineers. Elements of dynamic simulation of processes under open-loop and closed-loop operations for both linear and non-linear processes will be discussed. Concepts of feed-back, feed-forward and cascade (type of feedback) control of processes via common control algorithms will be covered. Aspects of stability, controller tuning and control loop performance optimization will also be discussed.

Course Objectives:

Equip students with the necessary fundamental theory and tools in order to address the following queries:

- Why is automated control necessary and how is it done
- What is the difference between open-loop and closed-loop system dynamics
- What are the elements of a closed-loop control system
- When, where, and why does a closed-loop system become unstable and how do we rectify this

Textbook:

Process Dynamics and control, 3rd Edition

By Seborg, Edgar, Mellichamp and Doyle

Published by John Wiley & Sons, 2011

Note: Other texts will be used for reference purposes.

Software:

Matlab/Simulink: This is an interactive environment for system simulation and control. Utilizing a block diagram interface, it can be used to model, simulate and analyze multidomain systems for process control and dynamics. It is available in the C-233

microlab as well as remotely on <https://apps.rutgers.edu/> (you will need to install a Java application and then log in with your netID. This software is an extremely important requirement for the course

Assessment (%):

Quizzes: 25

Matlab/Simulink: 30

Midterm 1: 20

Midterm 2: 25

Course Syllabus: (Subject to change) Also some of the lessons will be hands on where we will be using Maltab/Simulink in Class.

Quizzes will be on Tuesdays toward the last 20 mins of the class.

Lesson	Date	Topic	Chapter
1	Sep 5	Course Organization Introduction to Process Simulation & Control	1
2	Sep 7	Process Dynamics and Simulation	2
3	Sep 12	Introduction to Matlab and Simulink	2
4	Sep 14	Laplace transforms	3
5	Sep 19	Laplace transforms	3
6	Sep 21	Transfer functions and state space models	4
7	Sep 26	Transfer functions and state space models	4
8	Sep 28	Dynamic response of 1 st and 2 nd order systems	5
9	Oct 3	Dynamic response of 1 st and 2 nd order systems	5
10	Oct 5	Dynamic response of higher order systems	6
	Oct 10	Mid term 1	
11	Oct 12	Feedback control	8
12	Oct 17	Feedback control	8
13	Oct 19	Control system design	10
14	Oct 24	Control system design	10

16	Oct 26	Closed loop control systems	11
17	Oct 31	Closed loop control systems	11
18	Nov 2	PID control	12
19	Nov 7	PID control	12
20	Nov 9	Control design	12
21	Nov 14	RGA analysis and control pairing	13
22	Nov 16	Multivariable control	18
23	Nov 21	Feed forward control	15
24	Nov 28	Feed forward / Feed back control	15
	<u>Nov 30</u>	<u>Mid term 2</u>	
25	Dec 5	Matlab/Simulink	
26	Dec 7	Matlab/Simulink	
27	Dec 12	Matlab/Simulink	