155:422 Process Simulation & Control Fall 2024

Webpage: Canvas course site. Please ensure notifications are on so that you receive notifications when announcements are made and when material is uploaded.

Course format: The course will consist of In-person Lectures. You are expected to have your laptop and worksheets available to submit "in-class" work.

Class:
Tuesdays (350-510PM): FBO-EHA
Thursdays (350-510PM): FBO-EHA (Laptops will be required to run MATLAB)

Office hours: Friday 2-4 pm on Zoom
(https://rutgers.zoom.us/my/yannis?pwd=UStsWlYzSDVXQTB0MVc0eWVnTVVoQT09)

Instructor:
Prof. Ioannis (Yannis) P. Androulakis; yannis@soe.rutgers.edu; www.ipandro.com

TA:
Mr. Praveenkr Ravikumar; pr585@scarletmail.rutgers.edu

Course Description:
This course is an introductory description of the 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. MATLAB will be used to solve a variety of process control problems. Concepts of feedback, feed-forward, and cascade (type of feedback) control of processes via standard 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 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?
- How can MATLAB be applied to solve process control problems?

Software:
MATLAB: You would need to install the academic version of Matlab (software.rutgers.edu) and detailed instructions are present in a presentation inside Canvas under the "InstallingMATLAB.pptx". This software is an extremely important requirement for the course. Please download the software as soon as possible. You are expected to be familiar with MATLAB logic, syntax, and several in-built MATLAB functions that you would have learnt in your Comp. Methods 307 class (e.g., ode45, solve, vpasolve, fsolve, fminsearch, lsqnonlin, trapz). The first week of this class will focus on a refresher. A good practice would be to go through your Comp. methods 307 material and

ensure you download and have accessible, the MATLAB codes and templates related to the above-mentioned in-built functions.

Textbook: Process Dynamics and Control, Sebog, Edgar, Mellichamp, Doyle. Wiley (REQUIRED)

Materials

The material for this course is copyrighted and may not be distributed or posted on any other website without permission. Noncompliance with this policy will be treated as a violation of the Rutgers Code of Student Conduct and will be referred to the Office of Student Conduct for action.

Academic Integrity

All work should be your work, and you should work alone on the different deliverables. However, you are strongly encouraged to collaborate while working on homework problems ONLY. Discussion and collaboration are allowed to foster the exchange of ideas. We fully expect that you adhere to all this as part of the Rutgers academic integrity policy, which you should be aware of: http://nbacademicintegrity.rutgers.edu/home/academic-integrity-policy/ . Any form of copying, cheating, or plagiarism will be immediately reported. You should contact the instructor if you need more clarification.

Course Load and Special Accommodations:

The course is designed to be challenging but flexible to conform to everyone's busy and different schedules. The workload is expected to be not more than the usual requirement for a 3-credit course. The course is also designed so that time will not be the rate-limiting step, so everyone will have ample time to complete deliverables. If you require any special accommodations (e.g., personal, health, part-time work, coop, internship, etc.) please let me know in advance. I am happy to work with you to give you extra time or arrive at another workable arrangement. Official accommodations can also be arranged through ODS.

Assessment: total 100%

In-class work: 20%
Assignments: 20%
Three exams: 3x15%
Final presentation: 15%

Submission methods/deadlines:

All submissions must be uploaded to CANVAS as a PDF, Matlab, or Simulink files, depending on the nature of the work. Details will be provided for each submission.

Course Description:

Lectures: This will be an in-person live lecture. Slides will be uploaded post-lecture.
Assignments: This will include technical-style questions for derivation where MATLAB may be required.
Solutions: All solutions will be posted in CANVAS after and occasionally before the deliverable is due.

Grading policy:

We will use an absolute grading style so that at any point of time you know where you stand.

$$A: 1000 - 900;$$

$$B+: 899-800;$$
$$B: 799-700;$$
$$C+: 699-600;$$
$$C: 599-500;$$
$$D: 499-450;$$
$$F: 449-0;$$

Calendar:

Please check the online schedule