Sabancı University Faculty of Engineering and Science

ENS 206: System Modelling and Control

Spring 2022 - 2023 Weekly Schedule: T 8:40-9:30, R 8:40-10:30

Instructor: Melih Turkseven melih.turkseven@sabanciuniv.edu

Office Hours: TBD

Disclaimer: ***We may have to revise the course plan according to the countrywide reassessment to be made regarding higher education. This is expected to happen at the beginning of April. The content to be delivered is certain but the method of course delivery, the number and dates of exams, and some other details are subject to change.***

Description: This course will enable students to build mathematical models from first principles that represent behaviors of various physical systems (such as mechanical, electrical, and electromechanical systems). In addition to system modeling, the course also introduces basic concepts of control engineering.

Textbook: System Dynamics, Katsuhiko Ogata, Pearson Prentice Hall Learning

Outcomes: • Develop system response to various inputs • Utilize basic engineering approximations to simplify the models • Learn analytical methods, such as Laplace's transformation and state space approach for modeling dynamic systems • Learn Matlab/Simulink for dynamic system simulation and control • Use time-domain and frequency-domain analysis of dynamic systems to predict system performance • Introduce basic concepts in control systems Important

Notes:

- Quizzes will be conducted through SUcourse and students will be expected to participate on Zoom. Students are required to turn on pc cameras, and mics. The assessment sessions can be recorded.
- Students may be called for oral assessments in the following days of exams.
- To qualify for make-ups the average score of both homework assignments, and quizzes should be at least 20 out of 100.
- Any possible make-up exam will be scheduled at the end of the semester. In fairness to those who take the original exam, the make-up will include all the topics covered at the time of the exam. All the excuses and medical reports must be submitted before the exam.
- Recitation sessions will be held online
- MATLAB software will be extensively used. Students are expected to have a running version on their personal computers. We will provide tutorials and examples suitable for those who have not used MATLAB before.
- The final exam spans the entire course content.

Course Plan:

Week 1	Introduction_ What does 'dynamic' mean?
Week 2-3 Recitation	Mathematical preliminaries, Differential equations & Concept of stability Getting started with MATLAB
Week 3-4 Recitation	Laplace's transformation Transfer function approach to modeling dynamic systems Example questions more on MATLAB
Week 5-6 Recitation	Analyzing the time domain response of dynamic systems & Case of mechanical systems Simulation with MATLAB & Example mechanical systems
Week 6-7 Recitation	Case of electrical and electromechanical systems Case of DC motor more examples
Week 7 Recitation	Linearization (Case of hydraulic systems) & More on Stability Simulation examples on the difference between linear/nonlinear, stable/unstable
Week 8	Review and Midterm Exam Recitation Q&A
Week 9-10 Recitation	Modeling in State-Space Modeling in State-Space
Week 11 Recitation	Frequency domain analysis of dynamic systems Analyzing dynamic systems in frequency domain
Week 12-13 Recitation	Introduction to control systems PID control Formulating closed-loop control
Week 14 Recitation	Implementing basic closed-loop control Implementation examples

Assessments:

- Final Exam: 50%
- Midterm Exam: 10%
- Assignments: 30%
- Quizzes: 10%