Fall 2019

ME 305-101: Introduction to System Dynamics

Luis Costa

Syllabus for

ME 305: Introduction to System Dynamics

Department of Mechanical Engineering

New Jersey Institute of Technology

Fall 2019

Instructor: Luis Costa
Email: ljc2@njit.edu
Lecture: Monday 6:00 PM - 8:50 PM, Mechanical Engineering Building 221
Office Hours: By appointment

Course Description

ME 305 - Introduction to System Dynamics is an undergraduate course introducing the principles of modeling the response of dynamic systems. Topics covered include state space, time and frequency domain analyses, and classical control theory. Numerical solution of dynamic models are performed in MATLAB. Applications to mechanical, fluid, electrical, and thermal systems are provided throughout the course.

Prerequisites and Corequisites

Students are required to have successfully completed Mech 236: Dynamics, ME 231: Kinematics, and Math 222: Differential Equations. There are no corequisites for this course.

Required Text

Ogata, K., *System Dynamics*, 4th Edition, Pearson, 2003, ISBN: 978-0131424623

References

- Dorf, R.C., Bishop, R.H., *Modern Control Systems*, 12th Edition, Pearson, 2010, ISBN: 978-0136024583
- Golnaraghi, F., Kuo, B.C., *Automatic Control*, 9th Edition, Wiley, 2009, ISBN: 978-0470048962
- Astrom, K.J., Murray, R.M., *Feedback Systems: An Introduction for Scientists and Engineers*, 2nd Edition, Princeton University Press, 2008, ISBN: 978-1400828739

Topics

- Review of complex algebra
- Review of differential equations
- The Laplace transform and inverse Laplace transform
- Lumped parameter modeling
- Energy methods in mechanical engineering
- Transfer functions and block diagrams
- State space modeling
- Time domain analysis
- Frequency domain analysis

- Classical control theory and stability analysis
- Feedforward and feedback control, PID controllers
- Applications to mechanical, fluid, electrical, and thermal systems

Homework and Other Assignments

Preferably assignments are to be typeset in a word processor and submitted electronically in PDF format to the instructor's email address before the start of class on the due date of the assignment. Use of LaTeXis strongly encouraged but alternatives with the ability to typeset equations are acceptable (e.g. Microsoft Word, Libreoffice Writer, Apple Pages). If submitting assignments written by hand, please use pencil or blue/black ink. Submissions must be legible or they **will not be graded**. Late assignments will not be accepted without documented exceptional circumstances. Homework solutions will be provided but not all assigned problems may be graded.

All computer programs will be submitted as email attachments in a file format that is ready to be successfully executed by MATLAB; computer programs will be graded as submitted without any modification from the instructor.

Exams

There will be two midterm exams and one final exam given. The first midterm will be given roughly one third of the way into the semester and will focus on the course material covered from the first week to the first midterm exam date. The second midterm will be given roughly two thirds of the way into the semester and will focus on the course material covered from the first midterm exam to the second midterm exam date. The final exam schedule will be provided in class and the final exam may include any material covered throughout the entirety of the course. Students absent to an exam without documented exceptional circumstances will be given a grade of 0 points. Make up exams will only be provided for those with documented exceptional circumstances.

Grading Policy

Homework	20%
Midterm Exam 1	25%
Midterm Exam 2	25%
Final Exam	30%

The end of semester raw grade is a weighted sum of each component listed above. A grading curve will be applied to each students' end of semester raw grade. The explicit curving procedure will be provided.

Extra Credit

There will be several opportunities for extra credit throughout the course. These will usually take the form of challenging homework problems. Extra credit points will be added to the combined midterm and final exam grades when determining the final grade.

Class Attendance and Absences

Class attendance is encouraged. There is no requirement for students to attend lectures and there is no penalty for absences. Students are responsible for regularly accessing updated lecture material and assignments from the course website. Topics will not be revisited due to student absence as there is a significant amount of material to be covered in this course. Certain extra credit assignments may be provided only in lecture and those will not be accepted at a later date.

Student Code of Conduct

Students are expected to comply with the NJIT Student Code of Conduct. Violations of the Student Code of Conduct may merit disciplinary action.