ORTA DOĞU TEKNİK ÜNİVERSİTESİ

Course Syllabus
Electrical and Electronics Engineering - 5670302
Feedback Systems, Fall 2021

Instructors & Schedule:

Section 1	Section 2	Section 3	Section 4
M. M. Ankaralı	K. Leblebicioglu	E. Özkan	A. Saranlı
Tue.: 08:40-10:30	Tue.: 08:40-10:30	Tue.: 08:40-10:30	Tue.: 08:40-10:30
Wed.: 13:40-15:30	Wed.: 13:40-15:30	Wed.: 13:40-15:30	Wed.: 13:40-15:30
mertan@metu	kleb@metu	emreo@metu	afsars@metu

Scope: This course aims for you to understand the behavior of systems and tools to enforce a designed behavior. It will reinforce your understanding of systems and their mathematical models; help you to develop a solid understanding of the notions of feedback and system stability. You will learn how to mathematically analyze linear system behavior and design feedback controllers.

Course Organization: This semester, as in (almost) all university courses, EE302 course organization will be based on distance and online education techniques, including all of the exams and course sessions.
In this course, we will follow a hybrid (asynchronous and synchronous) lecture strategy for teaching the course's technical content. In some parts, we will share pre-recorded video lectures (via METU-class page of the course) which covers the main lecture content for the associated part. This gives you the flexibility to review the material at your own time but also the responsibility to do this regularly. In some parts, we will directly give the lecture via synchronous online sessions. We (instructors and TAs) will also offer online office hours, question & answer sessions, and online tutorials (e.g., computational tools).

Prerequisite: EE301 Signals and Systems I.

Teaching Assistants

Elif Sarıtas	Aysegul Kilic
esaritas@metu	kilica@metu.edu

Main Text Book:

[**M**] N.S. Nise, Control Systems Engineering (6th Ed.), Wiley, 2011.

Lecture Notes:

[**L**] M. M. Ankarali, Open Source Lecture Notes on Feedback Systems, METU.
https://github.com/mertankarali/Lecture-Notes/tree/master/METU-EE302

Auxiliary and On-Line Resources:

[**A1**] K. Ogata, Modern Control Engineering (5th Ed.), Pearson, 2010.

[**A2**] E. Özkan, EE302 Feedback Systems Teaching Blog. https://blog.metu.edu.tr/emreo/ee-302-feedback-systems/

[**A3**] Control Tutorials for MATLAB and Simulink (CTMS). http://ctms.engin.umich.edu/

[**A4**] Brian Douglas, Contro Systems (Video) Lectures. https://www.youtube.com/user/ControlLectures

Course On-Line Support: The course will be maintained through ODTUClass. Please check that you have your active e-mail address registered in ODTUClass and that you have access to the EE302 course content (https://odtuclass.metu.edu.tr/)

Course Grading:

Midterm	% 30
Quizzes	% 30
Final Exam	% 40
Bonus Project	% 5

Tentative Exam Schedule:

Quiz 1	Week 4 (lecture hours)
Quiz 2	Week 6 (lecture hours)
Midterm Exam	Week 8
Quiz 3	Week 11 (lecture hours)
Quiz 4	Week 13 (lecture hours)
Final Exam	Official Final Date

Exam Policy:

- We will proctor all (online) exams via the ODTUclass page of the course.
- During the quizzes and exams, we will be monitoring you via a video conference system. Your camera and microphone should be open during the defined time periods of the quizzes and exams.

Make-up Exam: If you miss an exam (quiz, midterm, final) with a valid excuse, you will able to take an online make-up exam at a later date. Also, if you encounter technical problems (such as internet connection problems or power failure etc.) during an online exam, you will be able take a (full or partial) make-up exam at a later date. However, you have to report your situation immediately to TAs and/or instructors. In such a case, you should avoid submitting your answer/solution (to the corresponding question) to be eligible for a (partial) make-up.

Bonus Project: We will have a bonus project during the term, that will hopefully involve an remote access to a physical experimental platform. We will announce the technical and schedule related details regarding the project later. The "Bonus" aspect of the grading will be conducted as follows: At the end of the semester we are going to apply a two-step grading process: The letter grades will first be assigned without considering the project grades and the letter grade boundaries will be determined. Then the bonus project grades will be added to the overall grades. After the addition, if a student grade crosses an upper-grade boundary, then the student will get a higher letter grade. In this way the letter grades of the students who did not participate in the project will not be affected by the letter grades of those who did.

Tentative Weekly Schedule and Reference Sections

Week	Outline	[M]	[A1]
1	1. Introduction (∼1 hr)	1	1
	2. Mathematical Modeling (∼ 7 hrs)	2.1-2.9	2.1-2.5
2	a) Electrical Circuits, Mechanical Systems, DC Motor	3.1-3.6	3
	b) System representations and block diagrams	5.1-5.4	
3	3. Time Domain Analysis (∼4 hrs)		
	a) Transient response	4.1-4.8	5.1-5.4
4	b) Steady-state error	7.1-7.4	5.7-5.8
	c) Effects of PID control		
5	4. Stability & Root-locus (∼7 hrs)		
	a) Routh-Hurwitz test	6.1-6.4	5.6
6	b) Root locus	8.1-8.7	6.1-6.3
	c) Root loci for PID controllers		
7	5. Frequency Response Analysis (∼6 hrs)		
	a) Nyquist criterion		
8	b) Relative stability	10.1-10.8	7.1-7.13
	6. Design in Frequency Domain (∼8 hrs)	11.1-11.4	
10	a) Lead compensation		
	b) Lag compensation		
11	7. State-Space Analysis (∼5 hrs)		
	a) State-space equations from transfer functions		9.1-9.2
12	b) Canonical forms	5.7	9.6-9.7
	c) Controllability and observability	12.1-12.7	10.1-10.2
13	8. State Feedback & Luenberher Observer (∼4 hrs)		10.5-10.7
	a) State feedback & pole placement		
14	b) Luenberger observer design		

Ethics:

The strength of the University and all our institutions depend on academic and personal integrity. As our students, we expect you to be honest and truthful. Ethical violations that we hope you will avoid include cheating on exams, plagiarism, improper use of the Internet and electronic devices, inappropriate collaboration, alteration of graded projects and exams, forgery and falsification, lying, facilitating academic dishonesty and helping others cheat. Warn your fellow students and if necessary, report any violations you witness to the course instructors.

Good wishes Note:

The pandemic conditions make it a challenging time for all of us. We wish you all a healthy and successful spring term. Control theory is an exciting field that we enjoy teaching. We hope that some of you will share that view.