EE302 Feedback Systems

Spring 2019 - Course Syllabus

Section 1	Section 2	Section 3	Section 4
M. M. Ankaralı	E. Özkan	K. Leblebicioğlu	A. Saranlı
A-311 / x2319	C-112 / x4502	D-303 / x2358	EZ-10 / x4529
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Scope: This course aims to reinforce systems and mathematical modeling concepts; to develop a solid understanding of stability and feedback notions; and to expose students to feedback controller design for linear systems.

Prerequisite: EE301 Signals and Systems I.

Assistants: To be announced.

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

Auxiliary sources:
[A1] K. Ogata, *Modern Control Engineering (5th Ed.)*, Pearson, 2010.
[A2] E. Kocaoğlan, *Lecture Notes on Linear Control Systems.* METU.
[A3] R.C. Dorf and R.H. Bishop, *Modern Control Systems (12th Ed.)*, Pearson, 2014.
[A4] Control Tutorials for MATLAB and Simulink (CTMS) `http://ctms.engin.umich.edu/`

Grading:

Midterm-1	27%
Midterm-2	27%
Final Exam	35%
Homeworks	8%
Attendance	3%
Bonus Project*	5%

* Details about the bonus project will be announced later.

Attendance: Students must attend the section in which they are registered. Attendance in other sections will not be counted in the attendance grade.

Make-up Exam: One make-up exam will be granted *only* to those with an *official* excuse, e.g., a valid medical report approved by the university health center. The make-up exam will at the end of the term and will cover all subject matter.

Final and NA Criteria: The students who fail to take both MT1 and MT2 without an official excuse will not be allowed to take the final exam and will directly get the "NA" grade.

Web-page: The course will be maintained through `ODTUClass`. Please check that you have your active e-mail address registered in `ODTUClass`. (`https://odtuclass.metu.edu.tr/`)

Effect of Bonus Project Grades: At the end of the semester we are going to apply a two-step grading process as follows: The letter grades will first be assigned without considering

the project grades (as we always did in previous years) 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's 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 schedule:

Week	Outline	[M]	[A1]
1	1. Introduction (∼1 hr)	Ch. 1	Ch. 1
2	2. Mathematical Modeling (∼7 hrs)	2.1–2.9	2.1–2.5
	a) Electric Circuits, Mechanical Systems, DC Motor	3.1–3.6	3
3	b) System representations and block diagrams	5.1–5.4	
	3. Time Domain Analysis (∼4 hrs)		
4	a) Transient response	4.1–4.8	5.1–5.4
	b) Steady-state error	7.1–7.4	5.7–5.8
5	c) Effects of PID control		
	4. Stability (∼7 hrs)		
6	a) Routh-Hurwitz test	6.1–6.4	5.6
	b) Root locus	8.1–8.7	6.1–6.3
7	c) Root loci for PID controllers		
	5. Frequency Response Analysis (∼6 hrs)		
8	a) Nyquist criterion		
	b) Relative stability	10.1–10.8	7.1–7.13
9	6. Design in Frequency Domain (∼8 hrs)	11.1–11.4	
	a) Lead compensation		
10	b) Lag compensation		
11	7. State Equations (∼5 hrs)		
	a) State 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 (∼4 hrs)		10.5-10.7
	a) Pole placement		
14	b) Observer design		