MTRE 4010 — Advanced Controls
2019 Spring
TR 9:30–10:45
Room Q 314

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Office hours: T 1:30–2:30, W 9:00–12:00, R 1:30–2:30

Textbook: Control Systems Engineering, by Norman Nise

Prerequisites: ((MTRE 4001 and MTRE 4002L) or EE 4201 or (ME 3501 and ME 4501)) and MATH 3260 and Engineering Standing

Course Description: This course is an advanced study of modern control systems focused on control theories and system applications. It covers the basic theoretical methods and mathematical tools for analysis and design of control systems. Topics that will be included are state-space variable method, system transfer function, discrete-time systems, z-transforms, digital control, fundamentals of modern control systems, analysis and design techniques such as controllability, observability, Ackerman's formula, and pole placement.

Learning Outcomes: After completing this course, you should be able to

1. Derive the mathematical model and transfer function of dynamic systems.
2. Analyze and design a control system using the state-space variable method.
3. Understand a discrete-time system and its mathematical representation.
4. Perform Z-transforms for analysis and design of digital control systems.
5. Apply modern control theories for analysis and design of control systems such as controllability, observability, Ackerman's formula, and pole placement.
6. Understand applications of various control systems
7. Use MATLAB/Simulink to analyze and design linear control systems.

Exams: The schedule will be announced at least one week in advance. Exams will cover material from assignments and the textbook as well as lecture notes. The final exam is comprehensive. You will be allowed to drop one test grade for the term. If you are absent during test day for any reason (excused or not), you will use that test as your drop test (including final). Likewise, one in-class quiz grade will be dropped.

Grading:

- Online quizzes — 10%
- State-space project — 10%
- In-class quizzes — 20%
- Four exams (three during semester and a comprehensive final), best three out of four — 60%

– In other words, there are four tests but your grade is only based on the best three scores. (Thus the final is optional.) Each test grade counts for twenty percent of the course grade.

Communication: Course material will be disseminated in D2L including lecture notes etc. All official course announcements will sent via email, which is also the surest means of contacting the instructor for any issues or requests. Please do not use D2L for email, but rather, send messages to the address given at the top of this document.

The University provides all KSU students with an "official" email account with the address "students.kennesaw.edu" or "kennesaw.view.usg.edu" (in D2L). As a result of federal laws protecting educational information and other data, this is the sole email account you should use to communicate with your instructor or other University officials.

Attendance Policy: A student is responsible for any material covered in class.

Academic Honesty: Every KSU student is responsible for upholding the provisions of the Student Code of Conduct, as published in the Undergraduate and Graduate Catalogs. Section 5c of the Student Code of Conduct addresses the universitys policy on academic honesty, including provisions regarding plagiarism and cheating, unauthorized access to university materials, misrepresentation/falsification of university records or academic work, malicious removal, retention, or destruction of library materials, malicious/intentional misuse of computer facilities and/or services, and misuse of student identification cards. Incidents of alleged academic misconduct will be handled through the established procedures of the Department of Student Conduct and Academic Integrity (SCAI), which includes either an informal resolution by a faculty member, resulting in a grade adjustment, or a formal hearing procedure, which may subject a student to the Code of Conducts minimum one semester suspension requirement. Information about the Honor Code can be found at `https://web.kennesaw.edu/scai/content/ksu-student-code-conduct`.

General Comments There will be absolutely no makeup test or quiz available in order to guarantee the course grade being fair to everyone in the classroom; one has to take the same test at the same time as everybody else.

Tentative Class Schedule:

Tuesday	Thursday
Jan 8th **1** Course introduction Review classical controls Digital controls introduction	10th **2** §13.3 — z-transform
15th **3** §13.4 — Transfer functions	17th **4** §13.5 — Block diagram reduction *Quiz*
22nd **5** §13.6 — Stability	24th **6** §13.10–11 — Compensator design and implementing digital compensators
29th **7** *review*	31st **8** *Exam I*

Tuesday	Thursday
Feb 5th **9** §2.5 — Modeling translational mechanical systems	7th **10** §2.6–7 — Rotational systems and systems with gears
12th **11** §2.8 — Electromechanical systems	14th **12** *review* *Quiz*
19th **13** §3.3–4 — State-space intro	21st **14** State-space cont'd
26th **15** §3.5 — Converting transfer function to state-space representation *Quiz*	28th **16** §3.6 — Converting state-space representation to transfer function
Mar 5th **17** *review*	7th **18** *Exam II*
12th **19** §12.1–2 — Controller design via state space	14th **20** Controller design cont'd
19th **21** §12.3 — Controllability *Quiz*	21st **22** §12.5 — Observer design
26th **23** §12.6 — Observability	28th **24** §12.4 and §12.7 — Ackermann's formula
Apr 2nd **Spring Break**	4th **Spring Break**
9th **25** §12.8 — Integral control *Quiz*	11th **26** ~~Project — controller design~~ *class cancelled — NCUR 2019*
16th **27** Project — observer design, begin Simulink simulation	18th **28** *review* State-space project due
23rd **29** *Exam III*	25th **30** Bonus material: linear quadratic optimal control (Last day of class)

Tuesday	Thursday
30th *no class*	May 2nd **31** **Final Exam**, 10:30–12:30