ME 4012 Syllabus

Course: ME4012: Motion Controls (3 credits)
Semester: Spring 2027
Instructor: Yi Chen Mazumdar

General Course Information

Description

ME 4012 Motion Controls teaches students how to derive dynamic models, design feedback control systems, utilize system identification methods to estimate parameters, implement controllers in different laboratory exercises, and apply their knowledge in a hands-on final project. Feedback control design techniques discussed in class include root locus, loop shaping, state space, and digital z-transform methods.

Course Learning Outcomes

- Students will be able to derive dynamic models of motion systems.
- Students will be able to obtain the models and parameters from experiments or system identification techniques.
- Students will be able to express models in transfer function and state space forms.
- Students will be able to design feedback control algorithms.
- Students will be able to implement the profiles in real-time digital control prototyping software (e.g. Arduino, Simulink, Matlab, LabVIEW).
- Students will be able to apply engineering principles to realistic problems.

Required Course Materials

No textbooks or other materials are required

Prerequisite

ME 3017 (System Dynamics), ME 3015, AE 3515, or equivalent

Grading Policy:

A (>90%), B (>80%), C (>70%), D (>60%) and F (<60%)

Participation/Attendance (5%), Problem Sets (25%), Exams (20%), Lab Assignments (25%), Final Project (25%). Extra credit opportunities (added to participation grade) will be given throughout the semester.

Description of Graded Components

Attendance and/or Participation: Attendance or participation is worth 5% of your grade. Each attendance sheet is weighted equally. Attendance will only be taken in-person during class, it is the student's responsibility to make sure that they remember to sign in. We will not be taking attendance via the Teams meeting recording since the purpose of the recording is to allow students to refer to the lecture later.

Each student is allowed a total of 2 automatic missed absences that they can use for sicknesses, interviews, institute excused travel, etc. This will be implemented at the end of the semester when points are added back to the final grade. Students who do not miss any lectures will also be given these points as extra credit.

Tests: There will be two tests and no final exam. The tests are closed-book and scientific calculators are allowed including TI-89. Tests will be during normal class time.

Problem Sets: Psets must be uploaded as PDFs to Canvas. Late psets will automatically be deducted points. Solutions are posted after the deadline and no late psets are accepted after solutions have been posted. You are encouraged to work with other students (work with your lab team, for example) but must indicate whom you collaborated with. Copying is against institute regulations. To receive credit for your work, you must show your steps. Poorly written and illegible psets will automatically be deducted points.

Labs: The class will have a series of structured labs that will teach students how to implement a variety of control systems. Depending on the number of students, individual lab sections may be split into two lab groups, A and B, and the groups will alternate every week between working on structured labs and meeting outside the lab on their final project. Students should work together in small teams. Each team will submit a single lab report for each lab. Students must participate in all the lab tasks. If you do not think your team is sharing responsibilities or hands-on activities well, please let the Prof/TA know immediately. Students who arrive late to structured lab will be deducted points.

Final Project: Students will design, model, build, implement, and control a system of their choice by the end of the semester. You can use the same teams as the labs. A list of suggested project topics will be provided but student-initiated projects are encouraged. Examples of previous projects can be found here (https://sites.gatech.edu/me4012). You can do something similar to previous projects, but should add a unique twist of your own. When structured labs are not scheduled, students should use lab time to work on their projects. At the end of the semester, teams will give a short presentation on their work and submit a short final video. Designs, modeling, hardware implementations, final video, and

final presentation (with appendices showing theory derivations) are required. Students will be asked to evaluate the contributions of their teammates as part of their final grade.

Emergencies: If you must miss a class, pset, exam, or structured lab due to an emergency, please email the professor and TA at least 24 hours in advance to make arrangements or reschedule. Do not attend in-person if you believe you have Covid. Last minute requests may not be noted on time. Please work with the Office of VP for Student Life (Dean of Students) if you are sick and need to miss a class or assignment. Exams cannot be rescheduled without an official letter from the Dean.

Course Policies

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review Georgia Tech's Honor Code and the student Code of Conduct.

Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Core IMPACTS

Not Applicable

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.