

EML 5311 : Control System Theory

Class Periods: M,W,F 6th period (1250-1340)

Location: CSE E118

Academic Term: Fall 2022

Instructor

Rick Lind

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Office Hours in 324 MAE-A or Zoom : T (0830:1025)

Course Description

(3 credits) Analyzing dynamic mechanical engineering control systems. Introduction to classical, digital, and state space techniques. Modeling, stability, transient response, and frequency response. Considers implementation.

Course Pre-requisites

EML 4312 or an equivalent undergraduate course in control theory

Course Objectives

The fundamental objective is a deeper appreciation for controls as applied to realistic systems. Specifically, students will understand the challenges that are involved in a rigorous design of a controller and any associated claims as to the properties of the resulting closed-loop system. The material will cover both synthesis and analysis of such systems with particular emphasis on conceptual understanding of the issues causing difficulty. Students must design controllers and analyze systems in such a way that a simple trial-and-error approach will not be sufficient but rather a methodical treatment of the dynamics will reveal the required feedback law and resulting characteristics of the system.

Materials and Supply Fees

This course does not have any fees.

Required Textbooks and Software

This course does not have a required textbook.

Recommended Materials

- G.C. Goodwin, S.F. Graebe and M.E. Salgado, "Control System Design," Prentice-Hall, 2001.
- L. Ljung, "System Identification," Prentice-Hall, 1987.
- J.M. Maciejowski, "Multivariable Feedback Design," Addison-Wesley, 1989.
- K. Ogata, "Modern Control Engineering," Prentice-Hall, 2002.
- J.E. Slotine and W. Li, "Applied Nonlinear Control," Prentice-Hall, 1991.
- K. Zhou, "Essentials of Robust Control," Prentice-Hall, 1998.

Attendance and Expectations

Students are required to attend every lecture. The entirety of exams and homeworks are constructed based on content and concepts presented in these lectures so you will not be properly prepared if you do not attend class. The lectures and recommended textbooks are meant to present complementary approaches and examples so the textbooks are supplementary to, but not replacements for, the lectures.

Excused absences must be consistent with university policies in the Graduate Catalog:

<https://catalog.ufl.edu/graduate/regulations>

and require appropriate documentation. Additional information can be found here:

<https://gradcatalog.ufl.edu/graduate/regulations/>

Evaluation of Grades

50%	Homework	Problems (some will require MATLAB) will be assigned periodically.
25%	Exam	A written exam will be given.
25%	Project	A project will be given near the end of the semester.

Grading Policy

Grades will be determined based on a curve that reflects the level of difficulty for each homework and exam. This curve is not based on class performance or the student average; instead, the curve is determined before the exam is given based on the amount of partial credit allowed for each solution. In this way, there is not any pre-determined grade distribution which means everyone is able to get an A.

Grade Evaluation

Any exam for which a student wants the grade to be evaluated must be given to the instructor within 48 hours, and before the start of the subsequent lecture, of when the graded exams were available to the class.

Missed-Exam Policy

Students may request approval to miss an exam for academic/professional reasons as long as the request is submitted at least 2 weeks before the exam. The student will take an exam, which will be different from the rest of the class, before their absent date.

Cheating Policy

Submissions must strictly reflect your own work so any use of unauthorized materials (other students, notes, phones, computers, books) will be strictly penalized. Cheating on an exam or in-class quiz will be reported to the Dean of Students Office and will result in automatic grade of 0 for the entirety of that exam or homework.

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript

of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code”. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

Campus Resources

- Health and Wellness

- **U Matter, We Care**

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

- **Counseling and Wellness Center**

<http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

- **Sexual Assault Recovery Services (SARS)**
Student Health Care Center, 392-1161.
- **University Police Department**
392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.
- Academic Resources
 - **E-learning technical support:** 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.
 - **Career Resource Center:** Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.
 - **Library Support:** <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.
 - **Teaching Center:** Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. <https://teachingcenter.ufl.edu/>.
 - **Writing Studio:** 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.
 - **Student Complaints Campus:** https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.
 - **On-Line Students Complaints:** <http://www.distance.ufl.edu/student-complaint-process>.