

ASEN 6519 Identification for Control

Course Description: This course will focus on the identification of models for physical processes which will be part of a feedback control system. Effective identification for control requires an understanding of the interplay between the robustness properties to modeling errors possessed by common control design methods and the modeling errors resulting from common identification methods. One third of the effort in the course will be devoted to robustness properties and design strategies for common control design methods. One third will be devoted to a broad survey of identification methods along with an in-depth analysis of the properties of a few specific methods. One third will be devoted to experimental simulation studies of the identification and control of specific example systems of interest to the class.

Instructor: Dale A. Lawrence. dale.lawrence@colorado.edu, Office: AERO 271. Lab: AERO 218/242.

Prerequisites: Undergraduate control or linear systems course.

Required Textbook: None. Material drawn from various texts and research literature.

Syllabus Outline

Topics	Weeks
Introduction and review: Review of linear systems concepts from a system identification point of view.	2
Frequency domain ID and Control Methods: Overview of general control/identification approach in the frequency domain. Detailed development of performance/robustness properties from a Bode/Nyquist control point of view, together with Empirical Transfer Function Estimation methods.	6
Simulation Project Reports	1
Time domain ID and Control Methods: Overview and detailed discussion of Recursive Estimation and model matching control methods.	5
Simulation Project Reports	1

Course Purpose and Learning Objectives

Purpose: introduce the field of system identification. Show how control design objectives influence requirements for identification, and how different identification methods affect model uncertainty.

Main Learning Objectives: Develop first hand experience in the application of particular system identification methods, as well as an understanding of the underlying theory. Develop an understanding of the breadth of the system identification field, encompassing time domain and frequency domain methods.

Teaching Approach

- Course will consist of approximately 2/3 instruction and 1/3 guided exploration.
- Students will select simulation examples based on their interest. These will be used in homework and in simulation projects to explore methods discussed in class.
- Students will present their projects to the class, and homework will be discussed in class so the variety of insights gained from various applications can be shared.

Grading

Homework 33%, Midterm project report (written and oral) 33%, Final project report 33%.

CLASSROOM BEHAVIOR

Both students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote or online. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. For more information, see the [classroom behavior](#) policy, the [Student Code of Conduct](#), and the [Office of Institutional Equity and Compliance](#).

REQUIREMENTS FOR COVID-19

As a matter of public health and safety, all members of the CU Boulder community and all visitors to campus must follow university, department and building requirements and all public health orders in place to reduce the risk of spreading infectious disease. CU Boulder currently requires COVID-19 vaccination and boosters for all faculty, staff and students. Students, faculty and staff must upload proof of vaccination and boosters or file for an exemption based on medical, ethical or moral grounds through the MyCUHealth portal.

The CU Boulder campus is currently mask-optional. However, if public health conditions change and masks are again required in classrooms, students who fail to adhere to masking requirements will be asked to leave class, and students who do not leave class when asked or who refuse to comply with these requirements will be referred to Student Conduct and Conflict Resolution. For more information, see the policy on classroom behavior and the Student Code of Conduct. If you require accommodation because a disability prevents you from fulfilling these safety measures, please follow the steps in the “Accommodation for Disabilities” statement on this syllabus.

If you feel ill and think you might have COVID-19, if you have tested positive for COVID-19, or if you are unvaccinated or partially vaccinated and have been in close contact with someone who has COVID-19, you should stay home and follow the further guidance of the Public Health Office (contacttracing@colorado.edu). If you are fully vaccinated and have been in close contact with someone who has COVID-19, you do not need to stay home; rather, you should self-monitor for symptoms and follow the further guidance of the Public Health Office (contacttracing@colorado.edu).

For this class, attendance is not mandatory, but please inform the instructor if you cannot attend due to illness to ensure reasonable accommodation.

ACCOMMODATION FOR DISABILITIES

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner

so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the [Disability Services website](#). Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition, see [Temporary Medical Conditions](#) on the Disability Services website.

PREFERRED STUDENT NAMES AND PRONOUNS

CU Boulder recognizes that students' legal information doesn't always align with how they identify. Students may update their preferred names and pronouns via the student portal; those preferred names and pronouns are listed on instructors' class rosters. In the absence of such updates, the name that appears on the class roster is the student's legal name.

HONOR CODE

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the [Honor Code](#). Violations of the Honor Code may include, but are not limited to: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to Student Conduct & Conflict Resolution (honor@colorado.edu); 303-492-5550). Students found responsible for violating the [Honor Code](#) will be assigned resolution outcomes from the Student Conduct & Conflict Resolution as well as be subject to academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found on the [Honor Code website](#).

SEXUAL MISCONDUCT, DISCRIMINATION, HARASSMENT AND/OR RELATED RETALIATION

CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. University policy prohibits sexual misconduct (harassment, exploitation, and assault), intimate partner violence (dating or domestic violence), stalking, protected-class discrimination and harassment, and related retaliation by or against members of our community on- and off-campus. These behaviors harm individuals and our community. The Office of Institutional Equity and Compliance (OIEC) addresses these concerns, and individuals who believe they have been subjected to misconduct can contact OIEC at 303-492-2127 or email cureport@colorado.edu. Information about university policies, [reporting options](#), and support resources can be found on the [OIEC website](#).

Please know that faculty and graduate instructors have a responsibility to inform OIEC when they are made aware of any issues related to these policies regardless of when or

where they occurred to ensure that individuals impacted receive information about their rights, support resources, and resolution options. To learn more about reporting and support options for a variety of concerns, visit [Don't Ignore It](#).

RELIGIOUS HOLIDAYS

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance.

In this class, homework and written project reports have ample time allowed before the due dates, so students are expected to plan for holiday observances within that time. The oral portion of the first project report will be scheduled individually, so please work with the instructor to arrange a suitable day and time.

See the [campus policy regarding religious observances](#) for full details.