ENGG*4490 Sampled Data Control Design

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Winter 2021
Section(s): C01

School of Engineering
Credit Weight: 0.75
Version 1.00 - January 06, 2021

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1 Course Details

1.1 Calendar Description

This course introduces the theory and techniques required to analyze, design, and implement sampled data controllers on real, continuous time systems. Topics include sampling, system identification and modeling, delay, state-space and frequency domain approaches to control, emulation methods, and direct z-domain methods. In the course project, students will apply the techniques discussed in class to design and implement a computer based controller for a real physical system, then compare the actual results obtained to the expected theoretical results and discuss sources of error and limitations of their approach.

Pre-Requisites:	ENGG*3390, ENGG*3410
Restrictions:	This is a Priority Access Course. Enrolment may be restricted to the ESC specialization in the BENG and BENG:C programs. See department for more information.

1.2 Course Description

This course has three main components: it explores the fundamentals of using computers and other discrete
time tools to control real, continuous time, systems and it takes a deeper look at applying control theory to
real systems. The main goals of this course are to (1) teach students how to mathematically analyze and
control 'hybrid systems' using a number of different methods, (2) to apply those concepts to real physcal
systems, and (3) to teach students to write a well structured formal report.

1.3 Timetable

Lectures:

Tues, Thur 11:30AM - 12:50PM- Virtual

LAB:

Tues 01:30PM - 03:20PM- Virtual

Note: Lab will start in the week of Jan 18th.

1.4 Final Exam

There is no final exam. There will be two term exams.

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2 Instructional Support

2.1 Instructional Support Team

Instructor: Hadis Karimipour
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Telephone: +1-519-824-4120 x52506
Office: THRN 2409

Instructor: Michael Cooper-Stachowsky
Email: mstachow@uoguelph.ca

2.2 Teaching Assistants

Teaching Assistant: Shahrzad Hadayeghparast
Email: shadayeg@uoguelph.ca

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3 Learning Resources

Lecture Information: Lecture notes will be posted on Courselink after lectures
Project Information: Information for the course project will be posted within the project section of the
Courselink page.
Problem sets: Problem sets will be posted in the 'problem sets' section of courselink. Solutions to selected
questions will be posted to the same section in Courselink by the instructor and the GTA.

3.1 Required Resources

Digital Control System Analysis and Design (Textbook)
Digital Control System Analysis and Design, 4th edition C. Phillips, H. Nagle, and A.

Chakrabortty.,
, Pearson Press, 2015.

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4 Learning Outcomes

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5 Teaching and Learning Activities

Tentative lecture topics:

1. Review of Systems and Control concepts
2. Review of Signals concepts (including z-transform)
3. Review of state-space (in continuous and discrete time)
4. Modeling (linearization, using ‘black box’ data to generate a transfer function or state space representation)
5. Fundamentals of delay (in time and frequency domain, including Pade approximations)
6. Intro to Sampled data systems D/A and A/D
7. Emulation methods
8. Direct methods
9. Introduction/review of discrete time-frequency responses
10. ‘Free’ topics and final term test
11. Final project demos

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6 Assessments

6.1 Marking Schemes & Distributions

Term tests (2 test): 40%

Tuesday, Feb 9, 11:00 AM-1:00 PM

Tuesday, March 30, 11:00 AM-1:00 PM

Final Project: 60%
April 12, 2020 at 11:00pm EST to Crowdmark

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7 School of Engineering Statements

7.1 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink but these are not intended to be stand-alone course notes. Some written lecture notes will be presented only in class. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and labs.

7.2 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and lab sessions. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

7.3 Lab Safety

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

8 University Statements

8.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

8.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

8.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

8.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

8.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website
https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website
https://www.ridgetownc.com/services/accessibilityservices.cfm

8.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

8.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

8.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars
https://www.uoguelph.ca/academics/calendars

8.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via CourseLink and/or class email. All University-wide decisions will be posted on the COVID-19 website (https://news.uoguelph.ca/2019-novel-coronavirus-information/) and circulated by email.

8.10 Illness

The University will not normally require verification of illness (doctor's notes) for fall 2020 or winter 2021 semester courses. However, requests for Academic Consideration may still require medical documentation as appropriate.
