



Prescription

This course builds on and extends the principles of modern control systems engineering introduced in ECEN 315 to enable students to develop mathematical models and use these to design optimal control systems for real-world multivariable engineering systems. Kalman filters and linear quadratic regulators will be introduced and the principles and benefits of modern model-based predictive control systems will be outlined. Methods will be developed for continuous time system descriptions but techniques for converting to discrete time descriptions and for designing controls for discrete time systems will also be presented.

Course learning objectives

Students who pass this course should be able to:

1. Produce state-space models of a variety of linear and nonlinear electronic and mechanical systems (BE graduate attributes 3(a),3(c)),
2. Design continuous and discrete time controllers using state-space techniques, including optimal control methods such as LQR (BE graduate attributes 3(a),3(b)),
3. Design Luenberger state observers and Kalman filters, (BE graduate attributes 3(a),3(b),3(e)),
4. Use the Matlab software package to solve practical problems in control engineering (BE graduate attributes 3(d),3(f)).

Withdrawal from Course

Withdrawal dates and process:

<https://www.wgtn.ac.nz/students/study/course-additions-withdrawals>

Lecturers

Christopher Hollitt (Coordinator)

christopher.hollitt@vuw.ac.nz 04 4636965

223 Alan MacDiarmid Building, Kelburn

Teaching Format

This course will be offered in-person and online. For students in Wellington, there will be a combination of in-person components and web/internet based resources. It will also be possible to take the course entirely online for those who cannot attend on campus, with all the components provided in-person also made available online.

The course will include three weekly in person sessions, that will include both lecture material and tutorial questions. These sessions will be recorded and available online for students unable to attend the classes in person. There will additionally be a series of short unassessed Matlab based exercises for students to work through.

Student feedback

Student feedback on University courses may be found at:
www.cad.vuw.ac.nz/feedback/feedback_display.php

Dates (trimester, teaching & break dates)

- Teaching: 13 July 2020 - 18 October 2020
- Break: 17 August 2020 - 30 August 2020
- Exam period: 19 October 2020 - 25 October 2020

Class Times and Room Numbers

13 July 2020 - 16 August 2020

- **Tuesday** 13:10 - 14:00 – 531, Murphy, Kelburn
- **Thursday** 13:10 - 14:00 – 531, Murphy, Kelburn
- **Friday** 13:10 - 14:00 – 531, Murphy, Kelburn

31 August 2020 - 18 October 2020

- **Tuesday** 13:10 - 14:00 – 531, Murphy, Kelburn
- **Thursday** 13:10 - 14:00 – 531, Murphy, Kelburn
- **Friday** 13:10 - 14:00 – 531, Murphy, Kelburn

Set Texts and Recommended Readings

Required

The text below is available online, via the link on Talis. We will not follow the the text closely, but the text will be useful for providing extra examples and for an alternative explanation of various topics. The text will likely prove to be most useful for the first half of the course.

Recommended

- Astrom and Murray "*Feedback Systems: An Introduction for Scientists and Engineers*"

Mandatory Course Requirements

There are no mandatory course requirements for this course.

If you believe that exceptional circumstances may prevent you from meeting the mandatory course requirements, contact the Course Coordinator for advice as soon as possible.

Assessment

This course will be assessed through four equally weighed assignments.

Each assignment will include problems that will require simulation or control design to be carried out using Matlab. However, only basic Matlab familiarity is required.

Assessment Item	Due Date or Test Date	CLO(s)	Percentage
Assignments (4)	Weeks 5, 7, 9, 13	CLO: 1,2,3,4	100%

Penalties

Work submitted late will be subject to a penalty of 10% of the total mark per day (or part thereof). No work will be accepted once the solutions have been posted. ON occasions the solutions may need to be posted immediately after the due date, and this will be pointed out at the time that affected items are distributed.

Extensions

Individual extensions will only be granted in exceptional personal circumstances, and should be negotiated with the course coordinator before the deadline whenever possible. Documentation (eg, medical certificate) may be required.

Submission & Return

All work should be submitted via the submission page on the course web site. Unless otherwise noted, all work should be submitted as pdf files. Handwritten work that is scanned as a pdf is fine. Submission of matlab code alone will not be adequate.

Marking Criteria

Each assignment will be marked on three broad categories:

1. Clarity of explanation using the formalisms, conventions and vocabulary of control system engineering.
2. Efficacy of control system designs.
3. Correctness of computational work.

Required Equipment

The course will make use of the Matlab environment (including its Control Toolbox) for simulation and control system design. This software is available free of charge for students. Students should ensure that they download and install a working copy by the end of the first week of class at the latest.

Workload

In order to maintain satisfactory progress in ECEN 415, you should plan to spend an average of 10 hours per week on this paper. A plausible and approximate breakdown for these hours would be:

- Lectures and tutorials: 3 hours
- Reading and Extra Problems: 4 hours
- Assignments: 3 hours

Teaching Plan

See: https://ecs.wgtn.ac.nz/Courses/ECEN415_2020T2/LectureSchedule

Communication of Additional Information

All online material for this course can be accessed at https://ecs.wgtn.ac.nz/Courses/ECEN415_2020T2/

Links to General Course Information

- Academic Integrity and Plagiarism: <https://www.wgtn.ac.nz/students/study/exams/integrity-plagiarism>
- Academic Progress: <https://www.wgtn.ac.nz/students/study/progress/academic-progress> (including restrictions and non-engagement)
- Dates and deadlines: <https://www.wgtn.ac.nz/students/study/dates>
- Grades: <https://www.wgtn.ac.nz/students/study/progress/grades>
- Special passes: Refer to the Assessment Handbook, at <https://www.wgtn.ac.nz/documents/policy/staff-policy/assessment-handbook.pdf>
- Statutes and policies, e.g. Student Conduct Statute: <https://www.wgtn.ac.nz/about/governance/strategy>
- Student support: <https://www.wgtn.ac.nz/students/support>
- Students with disabilities: https://www.wgtn.ac.nz/st_services/disability/
- Student Charter: <https://www.wgtn.ac.nz/learning-teaching/learning-partnerships/student-charter>
- Terms and Conditions: <https://www.wgtn.ac.nz/study/apply-enrol/terms-conditions/student-contract>
- Turnitin: <http://www.cad.vuw.ac.nz/wiki/index.php/Turnitin>
- University structure: <https://www.wgtn.ac.nz/about/governance/structure>
- VUWSA: <http://www.vuwsa.org.nz>

Offering CRN: [18519](#)

Points: 15

Prerequisites: ECEN 315 (or PHYS 422)

Duration: 13 July 2020 - 25 October 2020

Starts: Trimester 2

Campus: Kelburn