School of
Engineering and Computer Science
Te Kura Mātai Pūkaha, Pūrorohiko

Prescription

This course extends previous control studies to cover the use of modern control techniques in shaping the behaviour of complex systems having multiple inputs and outputs, in both discrete and continuous time. Optimal control (LQR) and estimation (the Kalman filter) are introduced. The course concentrates on linear and linearised systems, but some introductory nonlinear material is presented, including applications to robot control.

Course learning objectives

Students who pass this course should be able to:

1. Produce state space models of both linear and non-linear mechanical, electrical and other real-world systems (Graduate Attributes 3a,c.).
2. Predict the behaviour of a system and analyse fundamental properties such as stability, controllability and observability (Graduate Attribute 3c.).
3. Design continuous and discrete time controllers using state-space techniques, including optimal control methods such as LQR (BE graduate attributes 3(a),3(b)).
4. Design Luenberger state observers and Kalman filters (BE graduate attributes 3(a),3(b),3(e)).
5. Use the Matlab software package to solve practical problems in control engineering (BE graduate attributes 3(d),3(f)).

Course content

2022: The course is primarily offered in-person, and there are components such as tests, labs, tutorials, and marking sessions which require in-person attendance. There will be remote alternatives for all the components of the course, but these are only available to students studying from outside the Wellington region. The remote option for tests will use a Zoom-based system for online supervision of the tests.

Students taking this course remotely must have access to a computer with camera and microphone and a reliable high speed internet connection that will support real-time video plus audio connections and screen sharing. Students must be able to use Zoom; other communication applications may also be used. A mobile phone connection only is not considered sufficient. The computer must be adequate to support the programming required by the course: almost any modern windows, macintosh, or unix laptop or desktop computer will be sufficient, but an Android or IOS tablet will not.

Withdrawal from Course

Withdrawal dates and process:
https://www.wgtn.ac.nz/students/study/course-additions-withdrawals

Lecturers

Dr Christopher Hollitt (Coordinator)

christopher.hollitt@vuw.ac.nz 04 463 6965

AM 223 Alan Macdiarmid Building, Gate 7, Kelburn Parade, Kelburn

Teaching Format

The course contact hours consist of two weekly face to face lectures and a weekly tutorial. These lectures cover control theory, while the tutorials cover problem solving, including use of the Matlab control toolbox. Tutorials also allow for discussion of the broader impact of control engineering, in areas such as system safety, energy efficiency and sustainability.

Outside of contact hours, students are expected to work on substantial control problems using Matlab simulations. Some of these problems are drawn from the areas of robotic or mechatronic system control, and from engineering systems encountered in energy production systems.

Student feedback

Previous instances of the course have identified a couple of areas;
1. Timing of assignments and feedback; The assessment structure has been reviewed for this year to eliminate a timing issue with the course.
2. A need for some high level review material; this will be incorporated into lectures.

Dates (trimester, teaching & break dates)

- Teaching: 11 July 2022 - 14 October 2022
- Break: 22 August 2022 - 04 September 2022
- Study period: 17 October 2022 - 20 October 2022
- Exam period: 21 October 2022 - 12 November 2022

Class Times and Room Numbers

11 July 2022 - 21 August 2022

- **Tuesday** 12:00 - 12:50 – 103, Murphy, Kelburn
- **Thursday** 12:00 - 12:50 – 103, Murphy, Kelburn
- **Friday** 12:00 - 12:50 – 103, Murphy, Kelburn

05 September 2022 - 16 October 2022

- **Tuesday** 12:00 - 12:50 – 103, Murphy, Kelburn
- **Thursday** 12:00 - 12:50 – 103, Murphy, Kelburn
- **Friday** 12:00 - 12:50 – 103, Murphy, Kelburn

Set Texts and Recommended Readings

Required

There are no required texts for this offering.

Mandatory Course Requirements

In addition to achieving an overall pass mark of at least 50%, students must:

- Achieve a mark of at least 40% in the practical test.
- Achieve a mark of at least 40% in the theory test.

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

Assessment Item	Due Date or Test Date	CLO(s)	Percentage
Assignments (3) (approx 12 hours each)	Weeks 4, 8, 11	CLO: 1,2,3,4,5	60%
Practical Test (2 hour)	Week 6	CLO: 2,4	20%
Theory Test (2 hours)	Assessment Period	CLO: 1,2,3	20%

Penalties

Late work will be penalised at 1% per working day, or part thereof.

Extensions

Extensions should be sought before the due date. We will use the extension request feature available on the ECS submission system.

Submission & Return

Work will be submitted and returned via the ECS submission system. Assignment solutions will be posted to the course wiki.

Marking Criteria

Each of the assignments will contain a mastery section, which will be worth 50% of the marks. This section will be largely formative and is intended to be realtively straightforward. It will be marked with relatively low resolution. The remainder of the assignment will be harder questions and marked for the quality of the technical work and of the explanations provided.

Workload

The student workload for this course is 150 hours.

Teaching Plan

See: https://ecs.wgtn.ac.nz/Courses/EEEN415_2022T2/LectureSchedule

Communication of Additional Information

All online material for this course can be accessed at https://ecs.wgtn.ac.nz/Courses/EEEN415_2022T2/

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-progess (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: 34029

Points: 15
Prerequisites: EEEN 315 (or ECEN 315)
Restrictions: ECEN 415
Duration: 11 July 2022 - 13 November 2022
Starts: Trimester 2
Campus: Kelburn