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

Prescription

This course presents the analysis and modelling of linear dynamic systems and the design of linear feedback controllers for such systems. There is a focus on electrical, mechanical and electromechanical systems and the dynamic response of these systems. Properties and advantages of feedback control systems and the design of such systems using various design techniques are covered, as well as the implementation of PID controllers.

Course learning objectives

Students who pass this course will be able to:

1. Understand analogies between different dynamic systems and to be able to mathematically model such systems in continuous time. In addition modelling of dynamic systems using software packages such as Matlab and Simulink will be required. 3(c) .
2. Understand the response of a dynamic system to an input signal and to be able to predict the response of a particular system. This applies the mathematical and engineering sciences, including physics, to real-life problems 3(a).
3. Understand the concept of feedback and how it influences the response of a system 3(a).
4. Understand the operation and implementation of lead, lag and PID compensation and be able to design such compensators in continuous time using Root Locus and frequency response techniques 3(b).
5. To synthesise and demonstrate the efficacy of solutions to part or all of complex engineering problems, including formulating models from first principles of engineering science and mathematics 3(b), 3(c), 3(f).
6. To perform practical experiments, such that an engineering goal is achieved, where additional information requires identification, evaluation and conclusions drawn prior to the goal being reached 3(d). Understand the issues of uncertainty and the limitations of the applied methods, including practical issues in the implementation of PID controllers (such as

Course content

The course studies dynamic systems encountered in a variety of instrumentation and mechatronic systems. It will begin with a study of mathematical modelling of such systems which allows the response of these systems to disturbances to be predicted and their stability to be assessed. The effects of feedback on dynamic systems will be studied, leading to the development of a number of different design techniques for producing control systems.

Withdrawal from Course

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

Lecturers

Daniel Burmester (Coordinator)

daniel.burmester@vuw.ac.nz 04 4639998

404 Alan MacDiarmid Building, Kelburn

Will Browne

will.browne@vuw.ac.nz 04 4635233 ext 8489

418 Alan MacDiarmid Building, Kelburn

Teaching Format

During the trimester there will be three lectures and one lab per week. One of the lecture sessions will typically be used for a tutorial.

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: 02 March 2020 - 07 June 2020
- Break: 13 April 2020 - 27 April 2020
- Study period: 08 June 2020 - 11 June 2020
- Exam period: 12 June 2020 - 27 June 2020

Class Times and Room Numbers

02 March 2020 - 22 March 2020

- **Tuesday** 16:10 - 17:00 – 118, Cotton, Kelburn
- **Wednesday** 16:10 - 17:00 – 118, Cotton, Kelburn
- **Friday** 16:10 - 17:00 – 118, Cotton, Kelburn

27 April 2020 - 07 June 2020

- **Tuesday** 16:10 - 17:00 – 118, Cotton, Kelburn
- **Wednesday** 16:10 - 17:00 – 118, Cotton, Kelburn
- **Friday** 16:10 - 17:00 – 118, Cotton, Kelburn

Other Classes

A weekly laboratory session will be in Cotton 249. A laboratory demonstrator will be available for a subset of that time, but there should be no expectation of demonstrator assistance at other times. Students may make use of the laboratories outside of the specified time when the lab is otherwise unoccupied, though there will be restrictions in the use of the propellor systems for safety reasons.

Set Texts and Recommended Readings

Required

We do not closely follow a particular textbook for this course, though students are *strongly* advised to routinely use a text to gain a different perspective on the material. We mostly follow the notation used in the recommended text by Nise, so that is the most obvious option. However, different texts suit different students, so a visit to the library is suggested to peruse the different possibilities. Some additional recommendations may be found in the course reading list.

Recommended

The library contains a number of other excellent control engineering texts which can be consulted for additional explanation or practice problems. Some additional reading material is also listed in the course reading list, as may be found on the wiki page.

Lecture notes, laboratory scripts and assignments will be posted to the course's ECS wiki page. While notes will be provided, students are advised to also take down their own notes in class. These should then be supplementeded with further reading from the recommended reading for the course.

- "*Control Systems Engineering*" by Norman S. Nise. Any edition is fine.

Mandatory Course Requirements

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

- Achieve a grade of at least 40% over the two project reports.

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 project reports, assignments, a test, and a final examination. The test will cover all material from the first six weeks of the course.

Assessment Item	Due Date or Test Date	CLO(s)	Percentage
Project Reports (counted equally)	Weeks 6 and 12.	CLO: 5,6	20%
Assignments (counted equally)	Weeks 4,6,8 and 10.	CLO: 1,2,3,4	20%
Test	Week 7	CLO: 1,2,3,4	10%
Final Examination (3 hours)	Examination Period	CLO: 1,2,3,4	50%

Penalties

Work submitted after the due date will incur a penalty of 10% of the full mark per working day. Late work will not be marked after the model solutions have been made available or if more than one week late.

Extensions

Extensions will be given only in exceptional circumstances, and if agreed **before** the due date.

Submission & Return

Assignments should be submitted into the labelled box on level 2 of Cotton building by the 5pm of the specified date or using the online submission system. Details for the correct submission mechanism will be provided with each item. Any late work should should **not** be submitted into the boxes, as they will not be regularly checked. Rather submit late work directly to the appropriate lecturer.

Assessment items will be returned during classes. If you miss collection of an item please see the lecturer. . Students should be aware that the length of marking of the midtimester laboratory report means that the reports will not be returned as swiftly as other assessment items.

Bachelor of Engineering students should be aware that copies of their assessed work may be retained for inspection by an accreditation panel.

Required Equipment

Students must have a ruler and a protractor. Several coloured writing instruments of some form will also be required. Availability of a scientific calculator having the capacity to perform trigonometric and complex number calculations will be assumed.

Workload

On average, students should plan to spend 10 hours per week on in this course.

Teaching Plan

See https://ecs.wgtn.ac.nz/Courses/ECEN315_2020T1/LectureSchedule

Communication of Additional Information

Any additional information regarding this course will be posted on the course wiki:
https://ecs.wgtn.ac.nz/Courses/ECEN315_2020T1/

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: 18516

Points: 15
Prerequisites: ECEN 203 (or 220 prior to 2016);

Restrictions: PHYS 422
Duration: 02 March 2020 - 28 June 2020
Starts: Trimester 1
Campus: Kelburn