Hardware-in-the-Loop & Rapid Control Prototyping

- Academic Year 2012-13
- Faculty of Engineering
- Unit Title: ACS6336
- 10 credits

Full Description:

This course represents an opportunity for students to gain hands-on experience of designing and implementing advanced controllers upon a challenging, real-world control problem. Uniquely, each student will be issued with their own, portable control hardware for the duration of the course. Students will learn how to interface such a system to industry-standard software using a data-acquisition device, before developing their own simulation models of the hardware. Hardware-in-the-loop design will then be employed to refine the model, from which a feedback controller will be synthesised. This will be tested in simulation before being implemented upon the hardware and refined in a cycle of rapid control prototyping.

Pre Uni Qual:
Proficiency in Matlab and Simulink strongly recommended.

Restrictions:
ACSE & Aero only due to required background knowledge.

Pre-requisites:
ACS317 (this would mean teaching ACS317 in the Autumn semester)

Co-requisites:

Contacts:

Teaching & Learning Methods
10 lecture hours
30 Lab hours including associated assessment
60 Independent Hours

Total Hours – 100

Assessment Methods
Lab Work 40%
Oral Viva 20%

Aims and Principles of Unit:
The aim of this course are as follows:
1. For students to gain practical experience of hardware-in-the-loop and rapid control prototyping techniques, using high-level design software and real-time data acquisition hardware.
2. For students will use these techniques to design and implement their own control algorithms upon a challenging real-world control problem.
3. For students to appreciate the central role of modelling in systems analysis and control design.
Learning Outcomes:
By the end of the unit, a student will be able to demonstrate the ability to:
1. Configure data-acquisition hardware to interface a real-world system to a PC,
2. Operate a real-world system using high-level design software,
3. Develop and analyse models of physical systems from first principles.
4. Describe, devise and appraise methods to identify the parameters required to model a real-world system,
5. Describe and appraise the differences between, firstly, a real-world system and a simulation model of that system, and secondly, the simulation model and a model used for control system design,
6. Describe, devise and evaluate methods to control a real-world system,
7. Describe and appraise the use and relevance of hardware-in-the-loop and rapid control prototyping in the design cycle.
8. Communicate clearly in oral and written presentations,
9. Find, interpret and use information independently.
10. Develop a control system to meet stringent performance criteria.

How teaching methods enable aims and outcomes to be achieved:
Learning outcomes 1-6 are accounted for by 18 lectures, supported by 8 tutorial sessions and 10 hours of lab-sessions. 40 hours of self-study are apportioned.

Learning outcomes 7-10 are accounted for by 6 lectures, followed by 35 hours of practical problem solving activities and 33 hours of self study.

How assessment methods enable aims and outcomes to be achieved:
Learning outcomes 1-5 are assessed via lab-based activities.

Learning outcomes 6-10 are assessed via a 10 minute oral viva with each student, together with a lab report. The oral assessments will be conducted on the same day and will therefore require up to four staff members to be on hand.

Lab activity assessment will be based upon a series of lab-sheet exercises for the students to complete within an allotted timeframe.

Unit evaluation:
The department has a standard procedure for collecting student feedback on every taught module and communicating the results and staff comments back to the students.