ES2G2-15 Electromechanical System Design and Control

23/24

Department
School of Engineering
Level
Undergraduate Level 2
Module leader
Hongyang Dong
Credit value
15
Module duration
10 weeks
Assessment
40% coursework, 60% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This module provides students with the skills necessary for system design, analysis, tuning, and control, fulfilling the essential knowledge requirements in electromechanical engineering applications.

Module aims

This module aims to equip students with an understanding of the fundamental principles of system design and control. It will enhance students' comprehension of control techniques through in-depth exploration of system modelling, analysis, tuning, and PID control. Real-world examples, including electromechanical systems, will be utilised to demonstrate the entire process of control system development. Additionally, this module will also introduce the principles of systems engineering to students, guiding students to expand their thinking about design to include the whole lifecycle.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be

covered. Actual sessions held may differ.

- Control fundamentals.
- System modelling for complex mechanical systems and electromechanical systems.
- Open-loop and closed-loop transfer functions.
- System analysis and tuning in the time domain.
- PID control.
- Root locus techniques.
- System engineering fundamentals.
- System vee.

Learning outcomes

By the end of the module, students should be able to:

- Develop mathematical modes of physical systems using appropriate physical laws and expressing the models with ordinary differential equations, utilise engineering analysis to demonstrate commonality in behaiour.
- Apply control fundamentals, including general concepts, definitions, specifications and objectives in system control; utilise block diagrams to represent systems.
- Design PID controllers and analyse system behaviour including stability analysis.
- Utilise computational methods in MATLAB/SIMULINK to apply concepts and techniques to analyse the behaviour of open loop physical systems, design feedback control systems (PID), analyse their behaviour, and assess their stability.
- Explain the overall concepts, processes and needs for a system approach to engineering in various industries and applications.

Interdisciplinary

Systems Engineering is interdisciplinary

Subject specific skills

Follow a methodical approach to engineering problem solving.
Model real-world mechanical systems efficiently.
Use appropriate equipment to develop and execute test plans to support electro-mechanical product validation and approval.
Comply with statutory and organisational safety requirements.

Transferable skills

Prioritise quality. Follow rules, procedures and principles in ensuring work completed is fit for purpose, and pay attention to detail / error checks throughout activities.
Exercise responsibilities in an ethical manner, with openness, fairness and honesty.
Commit to professional standards (or codes of conduct) of their employer and the wider industry.

Study

Study time

Type	Required
Lectures	15 sessions of 1 hour (10%)
Seminars	3 sessions of 2 hours (4%)
Supervised practical classes	4 sessions of 2 hours (5%)
Work-based learning	50 sessions of 1 hour (33%)
Online learning (independent)	6 sessions of 1 hour (4%)
Private study	65 hours (43%)
Total	150 hours

Private study description

65 hours guided independent learning (including VLE use).

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group D2

	Weighting	Study time	Eligible for self-certification
Assessment component			
Systems coursework	40%		Yes (extension)
Systems coursework - maximum 2,000 words.			
Reassessment component is the same			
Assessment component			
Examination	60%		No

	Weighting	Study time	Eligible for self-certification

- Answerbook Pink (12 page)
- Students may use a calculator
- Engineering Data Book 8th Edition
- Graph paper

Reassessment component is the same

Feedback on assessment

coursework individual and cohort feedback, exam - cohort feedback

Past exam papers for ES2G2

Availability

Courses

This module is Core for:

- Year 3 of DESA-H360 Undergraduate Electromechanical Engineering (Degree Apprenticeship)