ES1A6-15 Systems Modelling and Simulation

22/23

Department
School of Engineering
Level
Undergraduate Level 1
Module leader
Thomas Popham
Credit value
15
Module duration
24 weeks
Assessment
100% coursework
Study location
University of Warwick main campus, Coventry

Description

Introductory description

Systems modelling is an essential skill that underpins all Engineering disciplines allowing the Engineer to model a variety of problems.

Module aims

The use of models aims to provide information necessary to make decisions in the design and development of Engineering solutions or to investigate systems that are too costly, difficult or unethical to investigate physically. Vast numbers of bespoke software solutions are available to Engineers working in industry but this module will focus on designing and programming models from first principles showing the application of mathematical techniques and avoidance of modelling errors. There are design principles associated with models which ensure robust development and these will also be covered along with verification and validation techniques and applications to data modelling. These methods are inherited from software design processes and the synthesis will be exploited.

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.

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What is modelling and how is it used?
Model types, models as a tool, model design process akin to physical design processSystems Modelling: how are mathematical models developed, simulated and validated?
Model in the loop•
First/second order, block diagrams, Simulink•
Modelling of translational, rotational, electrical, thermal systems•
First order systems, input-output and transfer function representation, step and frequency response•
Second order systems, input-output and transfer function representation, step and frequency response•
Fourier analysis•
Key programming concepts (e.g. for-loops, functions, variables)

Learning outcomes

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

- Apply computational thinking to create software for solving modelling and simulation problems.
- Create and demonstrate a model developed with a user and purpose in mind.
- Simplify real engineering problems and approximate via a mathematical model.
- Understand and predict the response of a system to test inputs (i.e. step, sine) using analytical and simulation-based approaches
- Function effectively as an individual, and as a member or leader of a team.

Indicative reading list

Close, C.M., Newell, J.C. and Frederick, D.K., 2002. Modeling and analysis of dynamic systems. Wiley.

Karris, Steven T. Introduction to Simulink with engineering applications. Orchard Publications, 2006.

Subject specific skills

Follow a methodical approach to engineering problem solving.
Model real-world mechanical systems efficiently.

Transferable skills

Communicate confidently to create and maintain working relationships. Be respectful.
Work collaboratively as a team player. Able to work effectively within a team and interact with /help

others when required.

Study

Study time

Type	Required
Lectures	12 sessions of 1 hour (8%)
Seminars	(0%)
Project supervision	13 sessions of 1 hour (9%)
Practical classes	8 sessions of 1 hour (5%)
Work-based learning	30 sessions of 1 hour (20%)
Private study	87 hours (58%)
Total	150 hours

Private study description

87 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 A1

Assessment component	Weighting	Study time	Eligible for self-certification
Lab assessement Moodle quizzes	50%		No

Reassessment component is the same

	Weighting	Study time	Eligible for self-certification
Assessment component			
Group Project 15min Presentation and demonstration of a created simulation tool including peer assessment	50%		No
Reassessment component			
Individual project 10 page report			No

Feedback on assessment

individual feedback on lab assessment, cohort feedback on assessment, group feedback on project, peer feedback on project.

Availability

Courses

This module is Core for:

- Year 2 of DESA-H360 Undergraduate Electromechanical Engineering (Degree Apprenticeship)