ES1A0-15 Computational Modelling

22/23

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

Description

Introductory description

ES1A0-15 Computational Modelling

Module web page

Module aims

The use of models aims to provide information necessary to make decisions in the design and development of Civil Engineering solutions or to investigate solutions which are too costly, difficult or unethical to investigate physically. Vast numbers of bespoke software solutions are available to Civil 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.

Context: Introduction to Computational Modelling

- Development of mathematical models for simple engineering problems
- Conservation laws in engineering
  Use and programming of MATLAB in Computational Modelling
- MATLAB fundamentals
- Programming with MATLAB
- Linear system of equations and their use in civil engineering
- Linear Eigenvalue Analysis with MATLAB and its use in civil engineering problems
- MATLAB for structural mechanics problems
  Use of SAP2000 in civil engineering analysis and design problems
- Introduction to SAP2000
- Use of SAP2000 in civil engineering problems

Learning outcomes

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

- Simplify real civil engineering problems and approximate via a mathematical model.
- Represent multi-domain systems in a graphical programming environment.
- Derive models and relationships from data.
- Construct a model to predict system response to inputs using simulation methods.
- Demonstrate understanding that models are a tool developed with a user and purpose in mind.
- Describe the role of modelling and simulation in Engineering design and development.

Indicative reading list

Chapra S. C., Canale R. P., Numerical Methods for Engineers, 6th Ed., McGrawHill 2010.

Chapra, S. C., Applied Numerical Methods with MATLAB, McGrawHill, 2012.

Palm,W. J., Introduction to MATLAB for Engineers, 3rd Ed., McGrawHill, 2011

Subject specific skills

1. Plan and manage the design process, including cost drivers, evaluating outcomes, and working with technical uncertainty
2. Ability to apply relevant practical and laboratory skills

Transferable skills

1. Numeracy: apply mathematical and computational methods to communicate parameters, model and optimize solutions
2. Apply problem solving skills, information retrieval, and the effective use of general IT facilities
3. Communicate (written and oral; to technical and non-technical audiences) and work with others
4. Overcome difficulties by employing skills, knowledge and understanding in a flexible manner

Study

Study time

Type	Required
Lectures	14 sessions of 1 hour (9%)
Practical classes	17 sessions of 1 hour (11%)
Other activity	10 hours (7%)
Private study	109 hours (73%)
Total	150 hours

Private study description

109 hours of guided independent learning (including VLE use and support from Employer)

Other activity description

2 hours of revision lectures
8 hours of work-based project presentation and verification.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A2

	Weighting	Study time
Online Computer-based Exercises	30%	
Assessment of online computer-based exercises (Moodle quizzes) (1 hour)		
Work-based Project	70%	
Work-based Project (14 pages in length)		

Feedback on assessment

- Written feedback on work-based project.
- Cohort-level written feedback on online computer-based exercises.

- Support through advice and feedback hours.

Availability

Courses

This module is Core for:

- Year 1 of DESA-H221 Undergraduate Civil and Infrastructure Engineering (Non-integrated Degree Apprenticeship)