MATLAB®/Simulink for Vibrational Analysis and Energy Harvesting applications
2nd to 18th of December 2020

University of Strathclyde | Faculty of Engineering

Department of Naval Architecture Ocean and Marine Engineering

Topic Overview

For both academia and industry, MATLAB is an essential tool for state-of-the-art research in science and engineering. The MATLAB integrated development environment and straightforward interface allow users to quickly command the computational power of the toolkits, simulation, and modelling capabilities that constitute a development tool that has no rival. For this reason, MATLAB stands as a de facto programming language and environment, assisting the technical necessities of a broad range of engineers, researchers, and scientists.

In addition, a solid foundation in MATLAB is a valuable skill in the present job market. This course teaches computer programming fundamentals to those with limited to no prior experience, using the MATLAB programming system and language.

Assistant Prof. Andrea Coraddu, from the University of Strathclyde, is delighted to offer a hands-on approach to developing these skills targeted in towards applications in vibrational analysis and energy harvesting.

In this course, we will use MATLAB to explain general concepts in programming, which are general to any field of research or problem-solving, to build a strong foundation of programming concepts.

The course will advance to cover recursion, vectorisation, function handles, and algorithm efficiency during the morning sessions. The afternoon sessions will then cover the application of these concepts in vibrational analysis and energy harvesting during applied numerical sessions.All course material will be made available for a complete understanding of the related subjects, as well as for future consultation.

Contacts

Dr Andrea Coraddu
University of Strathclyde
Department of Naval Architecture, Ocean & Marine Engineering
andrea.coraddu@strath.ac.uk

Mrs Olena Karpenko
University of Strathclyde
Department of Naval Architecture, Ocean & Marine Engineering
olena.karpenko@strath.ac.uk

Cost

Early Bird Registration - **£1,200**
(valid until 15/11/2020)

Normal Registration - **£1,500**
(valid until 01/12/2020)

Location

Zoom live classes

Course Organisation

The course will be divided in 5 lectures, from 2nd to 18th of December 2020, each covering one of the five days of course, for a total of 30 hours.

A morning theoretical session (9:00 to 12:00) and an afternoon hands-on session (14:00 to 17:00) will be provided.

Content Details and Schedule

Wednesday 2nd of December 2020

09:00 – 12:00 – Theoretical Session - Language Fundamentals

- MATLAB Integrated Development Environment
- Data types, expressions, Indexing
- Control Flow (Conditional and Loop Control)
- Scripts and Functions
- Data Structures
- Advanced file Input and Output
- Graphics

14:00 – 17:00 – Practical Session

Hands-on: Warm-up exercises

Wednesday 9th of December 2020

09:00 – 12:00 – Theoretical Session - Simulink Programming Environment

- Introduction to Simulink
- The Commonly Used Blocks Library
- Simulink Model Creation
- MATLAB/Simulink for the solution of Differential Equations
- Laplace Transform and Transfer Function Analysis Method

14:00 – 17:00 – Practical Session

Hands-on:

a) Single Degree-of-Freedom (1DOF) - Free and Forced Oscillations
b) Two Degree-of-Freedom (2DOF) - Free and Forced Oscillations

Friday 11th of December 2020

09:00 – 12:00 – Theoretical Session - Mathematics

- Linear Algebra / Solving Systems of Linear Algebraic Equations
- Operations on Nonlinear Functions
- Data Analysis (Preprocessing, Summarising, Visualising Data)

14:00 – 17:00 – Practical Session

Hands-on: Linear Algebra and Data Analysis

Wednesday 16th of December 2020

09:00 – 12:00 – Theoretical Session - Advanced Mathematics

- Interpolation and Extrapolation
- Fitting Curves to Data
- Complex Numbers

14:00 – 17:00 – Applications

Hands-on:

a) Interpaloation and Extrapolation and fitting curves
b) Multiple Degree-of-Freedom (MDOF) systems - Free and Forced Oscillations

Friday 18th of December 2020

09:00 – 12:00 – Theoretical Session - Advanced Mathematics

- Integration
- Differentiation

14:00 – 17:00 - Applications

Hands-on:

a) Integration and Differentiation
b) Analysis of a Single Degree-of-Freedom Piezoelectric Vibration Energy Harvester System