Computational Fluid Dynamics

Module Information

2022.01, Approved

Summary Information

Module Code	7110MECH
Formal Module Title	Computational Fluid Dynamics
Owning School	Engineering
Career	Postgraduate Taught
Credits	20
Academic level	FHEQ Level 7
Grading Schema	50

Teaching Responsibility

LJMU Schools involved in Delivery
Engineering

Learning Methods

Learning Method Type	Hours
Lecture	11
Online	11
Tutorial	22

Module Offering(s)

Display Name	Location	Start Month	Duration Number Duration Unit
SEP-CTY	CTY	September	12 Weeks

Aims and Outcomes

Aims	The module aims to explore the underlying theory of commercial computational fluid dynamics (CFD)codes and to investigate their performance and reliability in engineering applications.Whilst the theoretical aspects of the method will be covered in lectures the module is intended to be practical in nature with students having the opportunity to practice via a range of tutorials and assignments using industry standard software.

After completing the module the student should be able to:

Learning Outcomes

Code	Number	Description
MLO1	1	Set up and validate efficient and accurate CFD models of a range of simple engineering flows under steady and unsteady conditions.
MLO2	2	Set up and validate an efficient and accurate CFD model of a complex flow (steady or unsteady) regime.
MLO3	3	Critically evaluate the output from a CFD analysis.
MLO4	4	Appreciate the theory underpinning commercial CFD codes.

Module Content

Outline Syllabus	Introduction to CFDReview the governing equations, N-S equations, continuity, and energy.Methods for the discretisation of the governing equations.Methods for handling advection/diffusion problems, upwinding etc.Solving for pressure fields.Application of boundary conditions.The use of appropriate turbulence models in CFD. Time averaging and themodification of the N-S equations to predict the effects of turbulence (RANS).Selection of appropriate turbulence model e.g. consideration of a number of differentmodelling approaches for example, Prandtl' mixing length model, k-epsilon model,Reynolds Stress Equation model, (RSM), Large Eddy Simulation (LES) methods.Modelling of the boundary layer. Law of the wall and use of wall functions.Basic iterative numerical methods for solving the discretised equations, use ofrelaxation, time steps etc.Meshless techniques.Critical analysis of CFD results, including errors and uncertainty in CFD calculationsand meshing strategy.
Module Overview	The module aims to explore the underlying theory of commercial computational fluid dynamics (CFD) codes and to investigate their performance and reliability in engineering applications.
Additional Information	This module aims to appraise and distinguish the features of high performance CFD codes and introduces the student to some of the intricacies associated with the modelling of fluid flow using CFD. The module aims to develop in the student a critical approach towards the appraisal of CFD predictions.

Assessments

Assignment Category	Assessment Name	Weight	Exam/Test Length (hours)	Module Learning Outcome Mapping
Test	Invigilated V.L.E Test	40	0	MLO1, MLO4
Report	CFD Project	60	0	MLO2, MLO3

Module Contacts

Module Leader

Contact Name	Applies to all offerings	Offerings
Mehdi Seddighi	Yes	N/A

Partner Module Team

Contact Name	Applies to all offerings	Offerings