Course guide
220069 - AOS - Application of Open-Source Cfd to Engineering Problems

Last modified: 19/04/2023

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 220 - ETSEIAT - Terrassa School of Industrial and Aeronautical Engineering.

Degree: BACHELOR'S DEGREE IN AEROSPACE TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN AEROSPACE VEHICLE ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).

Academic year: 2023 **ECTS Credits:** 3.0 **Languages:** English

LECTURER

Coordinating lecturer: Castilla Lopez, Roberto

Others: Raush Alviach, Gustavo Adolfo
Gamez Montero, Pedro Javier

TEACHING METHODOLOGY

There will be teaching classes that will stablish the fundamentals of CFD and models, as well as Open Source methodology.
Half the course will be based on projects, that the students will develop, by groups of three, with the tutorization of the lecturers. These projects will be evaluated at the end of the course.

LEARNING OBJECTIVES OF THE SUBJECT

1. Perform CFD simulations using Open Source software, and be able to:
-Create a suitable mesh for a moderately complex geometry and flow
-Prepare and launch a simulation
-Visualize the CFD results
-Compute relevant magnitudes from the CFD results, such as drag/lift coefficients or heat transfer coefficients
-Refine the mesh, if necessary, to ensure that the model has been accurately implemented

2. Understand the following CFD models (scope, limitations, computational cost?)
-Laminar incompressible flow
-Turbulent incompressible flows using RANS models
-Compressible flow

3. Be able to verify a flow solution using published experimental data or analytical methods

STUDY LOAD

Type	Hours	Percentage
Hours large group	30,0	40.00
Self study	45,0	60.00

Total learning time: 75 h

CONTENTS

Module 1: Basic Open Source CFD

Description:
-Introduction
-Installing and running OpenSource Software
-First hands-on problem
-Results visualization
-Mesh generation
-Second hans-on problem

Related activities:
Work 1, work 2 and work 3

Full-or-part-time: 25h
Theory classes: 10h
Self study : 15h

Module 2: Verification of CFD results

Description:
-The method of manufactured solutions
-Comparing our results with published results

Related activities:
Work 1, work 2 and work 3

Full-or-part-time: 25h
Theory classes: 10h
Self study : 15h

Module 3: Flow models

Description:
-Laminar incompressible flows
-Compressible flows
-Introduction to turbulent flows modelling

Related activities:
Work 1, work 2 and work 3

Full-or-part-time: 25h
Theory classes: 10h
Self study : 15h

GRADING SYSTEM

Work 1, weight: 50%
Work 2, weight: 50%

BIBLIOGRAPHY

Basic:
- Maric, T.; Hoepken, J.; Mooney, K. The OpenFOAM technology primer. S.l.: Sourceflux, 2014. ISBN 9783000467578.
- Patankar, Suhas V. Numerical heat transfer and fluid flow [on line]. New York: McGraw-Hill, cop. 1980 [Consultation: 16/11/2022]. Available on: https://www-taylorfrancis-com.recursos.biblioteca.upc.edu/books/mono/10.1201/9781482234213/numerical-heat-transfer-fluid-flow-suhas-patankar. ISBN 9780891165224.
- Versteeg, H. K.; Malalasekera, W. An Introduction to computational fluid dynamics : the finite volume method. 2nd ed. London: Pearson Education, cop. 2007. ISBN 9780131274983.
- Anderson, John David. Computational fluid dynamics. New York [etc.]: McGraw-Hill, cop. 1995. ISBN 0071132104.
- Hoffman, Klaus A.; Chiang, Steve T. Computational fluid dynamics for engineers. Wichita, Kansas: Engineering Education System, 1993. ISBN 0962373176.