Last update: 23-04-2019

220069 - Application of Open-Source Cfd to Engineering Problems

Coordinating unit: 205 - ESEIAAT - Terrassa School of Industrial, Aerospace and Audiovisual Engineering

Teaching unit: 220 - ETSEIAT - Terrassa School of Industrial and Aeronautical Engineering

Academic year: 2019

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

ECTS credits: 3 Teaching languages: English

Teaching staff

Coordinator: Roberto Castilla

Others: Manel Soria, David Del Campo, Pedro Javier Gámez Montero

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

Total learning time: 75h	Hours large group:	30h	40.00%
	Self study:	45h	60.00%

Content

Module 1: Basic Open Source CFD	Learning time: 25h Theory classes: 10h Self study : 15h

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

Module 2: Verification of CFD results	Learning time: 25h Theory classes: 10h Self study : 15h

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

Related activities:
Work 1, work 2 and work 3

Module 3: Flow models	Learning time: 25h Theory classes: 10h Self study : 15h

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

Related activities:
Work 1, work 2 and work 3

Qualification system

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

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Bibliography

Basic:

Hoffman, Klaus A.; Chiang, Steve T. Computational fluid dynamics for engineers. Wichita, Kansas: Engineering Education System, 1993. ISBN 0962373176.

Versteeg, H. K.; Malalasekera, W. An Introduction to computational fluid dynamics : the finite volume method. 2nd ed. London: Pearson Education, cop. 2007. ISBN 9780131274983.

Patankar, Suhas V. Numerical heat transfer and fluid flow. New York: McGraw-Hill, cop. 1980. ISBN 9780891165224.

Anderson, John David. Computational fluid dynamics. New York [etc.]: McGraw-Hill, cop. 1995. ISBN 0071132104.

Maric, Tomislav; Hoepken, Jens; Mooney, Kyle. The OpenFOAM technology primer. Sourceflux, 2014. ISBN 9783000467578.