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

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: 2022  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 establish 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

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>40.00</td>
</tr>
<tr>
<td>Self study</td>
<td>45,0</td>
<td>60.00</td>
</tr>
</tbody>
</table>

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 hands-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:**