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: 2017  
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 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>Total learning time: 75h</th>
<th>Hours large group: 30h</th>
<th>40.00%</th>
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</thead>
<tbody>
<tr>
<td>Self study: 45h</td>
<td></td>
<td>60.00%</td>
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# Content

## 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

**Learning 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

**Learning 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

**Learning time:** 25h  
  - Theory classes: 10h  
  - Self study: 15h

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## Qualification system

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

Basic:


