220069 - Application of Open-Source Cfd to Engineering Problems

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

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.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 75h</th>
<th>Hours large group:</th>
<th>30h</th>
<th>40.00%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Self study:</td>
<td>45h</td>
<td>60.00%</td>
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</table>
# 220069 - Application of Open-Source CFD to Engineering Problems

## Content

<table>
<thead>
<tr>
<th>Module 1: Basic Open Source CFD</th>
<th>Learning time: 25h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 10h</td>
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<tr>
<td></td>
<td>Self study: 15h</td>
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<tr>
<td><strong>Description:</strong></td>
<td></td>
</tr>
<tr>
<td>- Introduction</td>
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<tr>
<td>- Installing and running OpenSource Software</td>
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<td>- First hands-on problem</td>
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<td>- Results visualization</td>
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<td>- Mesh generation</td>
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<td>- Second hands-on problem</td>
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<tr>
<td><strong>Related activities:</strong></td>
<td>Work 1, work 2 and work 3</td>
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</tbody>
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<thead>
<tr>
<th>Module 2: Verification of CFD results</th>
<th>Learning time: 25h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 10h</td>
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<tr>
<td></td>
<td>Self study: 15h</td>
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<tr>
<td><strong>Description:</strong></td>
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<tr>
<td>- The method of manufactured solutions</td>
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<tr>
<td>- Comparing our results with published results</td>
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<tr>
<td><strong>Related activities:</strong></td>
<td>Work 1, work 2 and work 3</td>
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<table>
<thead>
<tr>
<th>Module 3: Flow models</th>
<th>Learning time: 25h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 10h</td>
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<tr>
<td></td>
<td>Self study: 15h</td>
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<tr>
<td><strong>Description:</strong></td>
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</tr>
<tr>
<td>- Laminar incompressible flows</td>
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<tr>
<td>- Compressible flows</td>
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<tr>
<td>- Introduction to turbulent flows modelling</td>
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<tr>
<td><strong>Related activities:</strong></td>
<td>Work 1, work 2 and work 3</td>
</tr>
</tbody>
</table>

## Qualification system

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

Basic:


