

**Module Description, available in: EN**

## *Computational Fluid Dynamics (CFD)*

**General Information****Number of ECTS Credits**

3

**Module code**

TSM\_CFD

**Valid for academic year**

2022-23

**Last modification**

2020-02-10

**Coordinator of the module**

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**Explanations regarding the language definitions for each location:**

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

	Lausanne			Lugano	Zurich		
<b>Instruction</b>					X E 100%		
<b>Documentation</b>					X E 100%		
<b>Examination</b>					X E 100%		

**Module Category**

TSM Technical scientific module

**Lessons**

2 lecture periods and 1 tutorial period per week

**Entry level competences****Prerequisites, previous knowledge**

- Knowledge of fluid mechanics: laminar, turbulent, compressible, incompressible, steady-state and non-steady-state flow
- Knowledge of thermodynamics: conservation of mass and energy, equation of state (ideal gas, incompressible fluid), heat capacity, thermal conductivity
- Basic knowledge of numerical methods
- Basic knowledge of CFD simulation methods and tools is desirable

## Brief course description of module objectives and content

This module provides students with an introduction to CFD by imparting knowledge of state-of-the-art techniques in computational fluid dynamics, with the emphasis on fluid physics and verification/assessment.

## Aims, content, methods

### Learning objectives and acquired competencies

Students who have completed this module are able to:

- understand the potential of computational fluid dynamics for product development and be aware of its limits
- verify simulation results and critically assess simulation models
- understand the properties of the numerics behind the code

### Contents of module with emphasis on teaching content

- **Motivation:** objectives of computational fluid dynamics, meaning and economic benefit of numerical simulation, integration of numerical simulation in product development, possibilities and limits
- **Introduction to physical and technical systems and their describing equations:** fluid mechanics, thermodynamics, others
- **Idealization and modeling:** classification of the simulation tasks (steady-state, transition, 2D, 3D, symmetry, etc.), modeling based on geometry, flow properties, boundary conditions
- **Verification and assessment:** solving equations correctly, solving the correct equations, interpretation of simulation results, error possibilities and sources

### Teaching and learning methods

Ex cathedra, practical exercises and case studies

### Literature

- H.K. Versteeg, W.Malalasekera, An Introduction to Computational Fluid Dynamics, Pearson Prentice Hall, 2007, Second Edition
- F. Moukalled, L. Mangani, M. Darwish, The Finite Volume Method in Computational Fluid Dynamics, Springer, 2015
- J. H. Ferziger, M. Peric, Computational Methods for Fluid Dynamics, Springer, 2002, Third Edition

## Assessment

### Certification requirements

Module does not use certification requirements

### Basic principle for exams

As a rule, all the standard final exams for modules and also all resit exams are to be in written form

### Standard final exam for a module and written resit exam

Kind of exam

written

Duration of exam

120 minutes

Permissible aids

No aids permitted

### Special case: Resit exam as oral exam

Kind of exam

oral

Duration of exam

30 minutes

Permissible aids

