Module Description, available in: EN

Computational Fluid Dynamics (CFD)

General Information

Number of ECTS Credits

3

Module code

TSM_CFD

Valid for academic year

2025-26

Last modification

2023-09-29

Coordinator of the module

Ernesto Casartelli (HSLU, ernesto.casartelli@hslu.ch)

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		
Instruction					**X** E 100%		
Documentation					**X** E 100%		
Examination					**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 competencies to be acquired

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

Module content with weighting of different components

- **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

Additional performance assessment during the semester

The module does not contain an additional performance assessment during the semester

Basic principle for exams

As a rule, all standard final exams are conducted in written form. For resit exams, lecturers will communicate the exam format (written/oral) together with the exam schedule.

Standard final exam for a module and written resit exam

Kind of exam

Written exam

Duration of exam

120 minutes

Permissible aids

Aids permitted as specified below:

Permissible electronic aids

none

Other permissible aids

open book

Exception: In case of an electronic Moodle exam, adjustments to the permissible aids may occur. Lecturers will announce the final permissible aids prior to the exam session.

Special case: Resit exam as oral exam

Kind of exam

Oral exam

Duration of exam

30 minutes

Permissible aids

No aids permitted