Module description

Computational Fluid Dynamics (CFD)

General information

Number of ECTS Credits

3

Abbreviation

TSM_CFD

Version

02.11.2016

Responsible of module

Prof. Dr. Ernesto Casartelli

Language

	Lausanne	Bern	Zürich
Instruction	☐ E ☑ F	☐ D ☐ E ☐ F	☐ D ☑ E
Documentation	☑ E ☐ F	☐ D ☐ E ☐ F	☐ D ☑ E
Examination	☑ E ☑ F	☐ D ☐ E ☐ F	☐ D ☑ E

Module category

☐ Fundamental theoretical principles
☑ Technical/scientific specialization module
☐ Context module

Lessons

☑ 2 lecture periods and 1 tutorial period per week

Brief course description of module objectives and content

This module provides students with a comprehensive 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 and methods

Learning objectives and acquired competencies

Students who have completed this module are able to:

- employ the potential of computational fluid dynamics for product development and be aware of its limits
- verify simulation results and critically assess simulation models
- systematically approach simulation tasks
- 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

Prerequisites, previous knowledge, entrance competencies

- 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

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 for final examinations (conditions for attestation)

None

Written module examination

- Duration of exam: 120 minutes
- Permissible aids: Lecture notes and electronic devices by agreement