

## Computational Fluid Dynamics (E040520)

**Course size** (nominal values; actual values may depend on programme)  
**Credits 3.0**      **Study time 90 h**      **Contact hrs** 30.0 h

**Course offerings and teaching methods in academic year 2017-2018**

A (semester 1)	lecture	15.0 h
	seminar: practical PC room classes	15.0 h

**Lecturers in academic year 2017-2018**

Degroote, Joris	TW03	lecturer-in-charge
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**Offered in the following programmes in 2017-2018**

	crdts	offering
Bridging Programme Master of Science in Fire Safety Engineering	3	A
Master of Science in Electrical Engineering Technology (main subject Automation)	3	A
Master of Science in Electromechanical Engineering (main subject Control Engineering and Automation)	3	A
Master of Science in Electromechanical Engineering (main subject Electrical Power Engineering)	3	A
Master of Science in Electromechanical Engineering (main subject Maritime Engineering)	3	A
Master of Science in Electromechanical Engineering (main subject Mechanical Construction)	3	A
Master of Science in Electromechanical Engineering (main subject Mechanical Energy Engineering)	3	A
Master of Science in Electromechanical Engineering Technology	3	A
Master of Science in Biomedical Engineering	3	A
International Master of Science in Biomedical Engineering	3	A
Master of Science in Biomedical Engineering	3	A
International Master of Science in Fire Safety Engineering	3	A
Master of Science in Fire Safety Engineering	3	A

**Teaching languages**

English

**Keywords**

Computational Fluid Dynamics, CFD, Fluent

**Position of the course**

An introduction to computational techniques in fluid dynamics

**Contents**

- Flow equations: conservation equations and state equations, mathematical character of flow equations
- Finite volume methods for diffusion and convection-diffusion: steady state diffusion, steady state convection-diffusion, central and upwind discretisations
- Higher order discretisation of convection-diffusion: quadratic upwind discretisation, non-linear upwind discretisation: TVD-schemes
- Pressure-velocity coupling: pressure oscillations, momentum interpolation, pressure correction algorithms.
- Turbulence models for viscous flows: Reynolds averaging, turbulent viscosity, two-equation eddy viscosity models, RSM and ASM, introduction to LES and DNS
- Grid generation and spatial discretisation: structured and unstructured grids, cell-

- centred and vertex-based finite volume methods
- Solution methods for systems of equations: direct methods, iterative methods, multigrid formulation
- Unsteady flows: implicit and explicit time stepping schemes

### **Initial competences**

Transport Phenomena

### **Final competences**

- 1 Analyse a flow problem with a commercial computational fluid dynamics package.
- 2 Argue selected models, discretisation techniques, solution techniques, grid and time step size.

### **Conditions for credit contract**

Access to this course unit via a credit contract is determined after successful competences assessment

### **Conditions for exam contract**

This course unit cannot be taken via an exam contract

### **Teaching methods**

Lecture, seminar: practical PC room classes

### **Extra information on the teaching methods**

Exercises in the PC room using a commercial package, no programming.

### **Learning materials and price**

Slides and course notes

### **References**

[1] An Introduction to Computational Fluid Dynamics: The Finite Volume Method (2nd edition), H. Versteeg and W. Malalasekera, Pearson Prentice Hall, 2007.

### **Course content-related study coaching**

### **Evaluation methods**

continuous assessment

### **Examination methods in case of periodic evaluation during the first examination period**

### **Examination methods in case of periodic evaluation during the second examination period**

### **Examination methods in case of permanent evaluation**

Report

### **Possibilities of retake in case of permanent evaluation**

examination during the second examination period is possible

### **Extra information on the examination methods**

Report on an exercise which has to be performed autonomously.

### **Calculation of the examination mark**