GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2017-2018

Simulation of Fires in Enclosures (E900525)

Course size (nominal values; actual values may depend on programme)

Credits 5.0 Study time 150 h Contact hrs 25.0 h

Course offerings in academic year 2018-2019

A (semester 2) English

Lecturers in academic year 2018-2019

Wahlqvist, Jonathan	LUND01 lecturer-in-charge
Husted, Bjarne	LUND01 co-lecturer
Rubini, Phil	LUND01 co-lecturer

Offered in the following programmes in 2018-2019	crdts	offering
International Master of Science in Fire Safety Engineering	5	A

Teaching languages

English

Keywords

CFD modelling, Navier Stokes, combustion, fire, numerical methods, soot, heat transfer

Position of the course

The course is given in the EM programme, second semester. The course is designed to provide basic knowledge of how the spread of fire and combustion gases is simulated using ”Computational Fluid Dynamics” (CFD), in fire safety design and fire investigations. It also provides an understanding of the limitations of the numerical and physical models used, and an awareness of the most common sources of error.

Contents

· Introduction to CFD · Time and length-scales in fires · Turbulence models · Numerical methods · Large eddy simulation (LES) · Combustion models · Radiation models · Soot models · Heat transfer models · Creation and processing of CFD models · Common errors and troubleshooting in CFD modelling

Initial competences

Prerequisites: Fire Dynamics.
Recommended qualifications: Fire Chemistry.

Final competences

1 Knowledge and understanding: be able to describe the physical models used for conservation of mass, material, energy, and momentum.
2 Knowledge and understanding: be able to describe various numerical methods for solving the equation sets.
3 Knowledge and understanding: be able to identify the limitations and most common sources of error of the model components used.
4 Skills and abilities: be able to calculate the spread of combustion gases in various enclosure configurations using CFD programs.
5 Skills and abilities: be able to assess calculated results against experimental data
6 Skills and abilities:be able to decide on how the uncertainty in a simulation can be estimated on the basis of assumptions included in the physical and numerical models used.
7 Skills and abilities:be able to understand and use professional terminology within the field of fire evolution simulation using CFD
8 Skills and abilities:be able to report on, both orally and in writing, and discuss the implications of the executed simulation of the spread of combustion gases in association with fire safety design and fire investigations.

9 Skills and abilities:be able to make use of material published in technical references and user manuals for advanced simulation programs for combustion gas spreading.
10 Judgement and approach:demonstrate insight into the possibilities and limitations of fire safety simulation methods, as well as their role in advanced building technical project planning and in human responsibility for their use
11 Judgement and approach: demonstrate capability for identifying his/her own needs for further knowledge and for on-going improvement of his/her own competence in fire safety simulation.

Conditions for credit contract

This course unit cannot be taken via a credit contract

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture, self-reliant study activities

Extra information on the teaching methods

The lectures are split into two main blocks of two days each; one in the very first week of the semester, the second in the end of March. Before the first block the students are asked to do a simple introductory assignment to help them be able to run the needed software once the actual assignments start. In between the two blocks the students complete 3 assignments. The first 2 assignments are discussed and evaluated during a computer lab, where 2 students and a teacher discuss the results of all simulations and the applicability to the theory learned during lectures. The third assignment is discussed in a similar fashion during another computer lab. After the second lecture block the students are asked to complete a multiple-choice questionnaire to both test their skills, but also to help them study for the exam.

Learning materials and price

Lecture notes, in English (free), available through e-learning portal.
User manuals for used software (FDS), in English (free), available through e-learning portal.
Instructions for assignments, in English (free), available through e-learning portal.

References

Lecture notes
User manuals for FDS.
SFPE-handbook Chapter 3:8 "Modelling Enclosure Fires Using CFD" by G.Cox and S. Kumar Carlsson, J.
Computational strategies in flame-spread modelling involving wooden surfaces, Brandteknik, Report 1028 Lic. thesis Lund 2003, chapter 4-6.

Course content-related study coaching

Evaluation methods

end-of-term evaluation and continuous assessment

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

Written examination with open questions, written examination with multiple choice questions, participation, assignment

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

Written examination with open questions, written examination with multiple choice questions, participation, assignment

Examination methods in case of permanent evaluation

Written examination with multiple choice questions, participation, job performance assessment

Possibilities of retake in case of permanent evaluation

examination during the second examination period is not possible

Extra information on the examination methods

Assessment: Written individual examination and approved individual assignments

Calculation of the examination mark

Final mark 3, 4 and 5 is based on:
- points for the written exam
- 3 grades: 3, 4, 5 corresponding with 50, 65 and 85 points

For overall approval the student must attend two seminars and have approved job assignments.