GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2018-2019

FEM and Constitutive Material Laws in Structural Engineering (E044940)

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 2018-2019

A (semester 1)	Dutch	seminar: practical PC room classes	8.75 h
		guided self-study	18.75 h
B (semester 1)	English	lecture	17.5 h
		seminar: practical PC room classes	10.0 h

Lecturers in academic year 2018-2019

Van Coile, Ruben	TW14	lecturer-in-charge
Allaix, Diego Lorenzo	TW14	co-lecturer

Offered in the following programmes in 2018-2019	crdts	offering
Bridging Programme Master of Science in Civil Engineering	3	A
Bridging Programme Master of Science in Civil Engineering	3	B
Master of Science in Civil Engineering	3	A
Master of Science in Civil Engineering	3	B

Teaching languages

Dutch, English

Keywords

- FEM
- Linear analysis
- Nonlinear analysis
- Constitutive material laws

Position of the course

‘FEM and Constitutive Material Laws in Structural Engineering’ builds upon knowledge regarding structural analysis, and concrete and steel structural behaviour and design. The course has a specialized nature and supports other courses further in the education program. The aims are to (i) learn the basic knowledge with respect to finite element methods, the different elements and their interpolation functions in a structural engineering context; (ii) give an overview of the different general constitutive material laws which are relevant for structural engineering applications; (iii) get familiar with the fundamentals of FEM analyses and the importance of modelling assumptions

Contents

- Element method for linear elastic problems: variational methods to express equilibrium, displacement method (element mesh, interpolation of displacements, equilibrium, assembling elements, solving the set of equations, convergence), application to specific problems
- Elements and their interpolation functions: element types, simple continuum elements by polynomial interpolation, isoparametric elements, numerical integration, practical considerations
- Linear and nonlinear problems: types of problems, nonlinear solvers (incremental, iterative and arc-length procedures)
- Constitutive material laws for civil and structural engineering applications
- Best practice in Finite Element Modelling of Engineering Structures

Initial competences

Knowledge of basic and advanced topics of mechanics of materials and structural analysis. Knowledge of concrete and steel material behaviour and design methodologies.

Final competences

1 Gain an insight into the working and possibilities of finite element methods.
2 Gain a critic insight about the application possibilities of different types of elements for structural engineering applications.
3 Be able to make appropriate choices with respect to the element mesh and solution method.
4 Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications.
5 Be able to execute a FEM analysis of a simple application and be able to perform a critical assessment of the obtained results

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

Guided self-study, group work, lecture, seminar: practical PC room classes

Learning materials and price

Study material made available throughout the lecture series
(+ reference work available through lib.ugent.be)
U. Haussler-Combe, Computational Methods for Reinforced Concrete Structures. Wiley, 2014.

References

• U. Haussler-Combe, Computational Methods for Reinforced Concrete Structures. Wiley, 2014.
• O. C. Zienkiewicz and R. L. Taylor, The finite element method - for solid and structural mechanics. Elsevier, 2005.
• R. D. Cook, Finite element modelling for stress analysis. John Wiley & Sons, 1995.
• K. J. Bathe, Finite Element Procedures, Prentice Hall, 1996.
• J. N. Reddy, An introduction to the finite element method, McGraw-Hill, 2005.

Course content-related study coaching

Lecturer and assistants can be consulted after appointment for further guidance

Evaluation methods

end-of-term evaluation and continuous assessment

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

Written examination

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

Written examination

Examination methods in case of permanent evaluation

Assignment

Possibilities of retake in case of permanent evaluation

examination during the second examination period is possible in modified form

Extra information on the examination methods

End-of-term evaluation: Closed book exam.
Continuous assessment: Projectwork.

Calculation of the examination mark

Periodic evaluation: 50%
Continuous evaluation: 50%
When less than 9/20 is obtained for either one of the parts, passing the full course is no longer possible. If the final score would in this case exceed 10/20, the final score will be reduced to 9/20.