The Finite Element Method
Div. of Solid Mechanics
Course program, vt2, 2013

Course description

The finite element method (FEM) is a numerical method able to solve arbitrary differential equations, i.e. boundary value problems. The method is today the most powerful numerical method within solid mechanics; this since arbitrary geometries and complex material models can be treated. Within the modern industry the finite element method is the key factor in many construction phases. Since the method is a solution method for any partial differential equations it can be used for any problem that is controlled by field equations, for instance heat conduction, diffusion, electromagnetism and solid mechanics.

The emphasis in the course is placed on the understanding of the fundamental principles of FEM and its numerical formulation. During the course the participants implement their own finite element program and thereby gain understanding of the method in detail.

Lectures:
Monday 13-15, MH:B, (18/3,15/4,29/4,6/5,13/5,20/5)
Tuesday 8-10, V:A, (9/4,7/5)
Wednesday 8-10, V:A, (20/3,17/4,24/4,15/5,22/5)
Thursday 8-10, E:A, (21/3,11/4,18/4)

Lectures: Mathias Wallin
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Mathias.Wallin@solid.lth.se
Tel. 046-222 79 94

Problem sessions: Eric Borgqvist, Eric.Borgqvist@solid.lth.se
Jonas Engqvist, Jonas.Engqvist@solid.lth.se
Marcus Alexandersson
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### EXAM WEEK

Wed: 5/6: Vic: 1A-D, Vic 2A 14-19
Course literature


Wallin, Mathias: "*Introduction to the Finite Element Method- Exercises*", Solid Mechanics, 2012. The exercises can be downloaded from the course website.

The course book can be bought at KFS.

Additional notes on transient problems is available at the course home-page.


The Matlab-toolbox CALFEM can be downloaded from our homepage (www.solid.lth.se).

Assignment

The course includes a mandatory assignment. The assignment is performed in groups of two, or individually. The assignment shall be handed in not later than May 27 at 16.00. The assignment will be graded with up to 5 points which can be added to the points obtained at the exam June 5. Note that the bonus points is only valid at the exam June 5, 2013. A report that is handed in after May 27 will be given 0 points. The report must be approved not later than June 12.

Submission

You should submit your report in PDF format to FHLF01@solid.lth.se or FHL064@solid.lth.se. In addition to your report you should also attach your m-files in the email. Moreover, a paper version should also be handed in to the division of Solid Mechanics.

Examination

The examination of the course consists of a final examination and an assignment. The total points for passing the exam is 30. Total points is 60.

The exam takes place
June 5, 13-19, Vic1A-D, VIC 2A
Preliminary lecture schedule

Lecture 1  18/3  Introduction to FE-analysis, Chap. 1 and Chap. 2
Lecture 2  20/3  Chap. 3
Lecture 3  21/3  Chap. 4
Lecture 4  9/4  Chap. 5  **FHL064**
Lecture 5  11/4  Chap. 6, Chap 7 (1D)
Lecture 6  15/4  Chap. 7 (3D), Chap 8
Lecture 7  17/4  Chap. 9
Lecture 8  18/4  Chap. 10 + Transient heat flow, Chap 11
Lecture 9  24/4  Chap. 12, Chap. 13
Lecture 10  29/4  Chap. 15 and 16
Lecture 11  6/5  Chap. 19
Lecture 12  7/5  Chap. 20
Lecture 13  13/5  Variational principles. **FHLF01**
Lecture 14  15/5  Chap. 17. **FHL064**
Lecture 15  20/5  Guest lecture. Jan Granlund
Lecture 16  22/5  Reserv

Exercises

Exercise 1  Chap. 2
Exercise 2  Chap. 3
Exercise 3  Chap. 4.
Exercise 4  Chap. 5, Chap. 6
Exercise 5  Chap. 7, Chap. 8
Exercise 6  Chap. 9 (not 9.4 and 9.5)
Exercise 7  Chap. 10
Exercise 8  9.4, 9.5 and Chap. 11
Exercise 9  Chap. 12, Chap. 13
Exercise 10  Chap. 15, Chap. 16
Exercise 11  Chap. 19
Exercise 12  Chap. 20
Exercise 13  Chap. 17 / Variational principles.
Exercise 14  Consultation