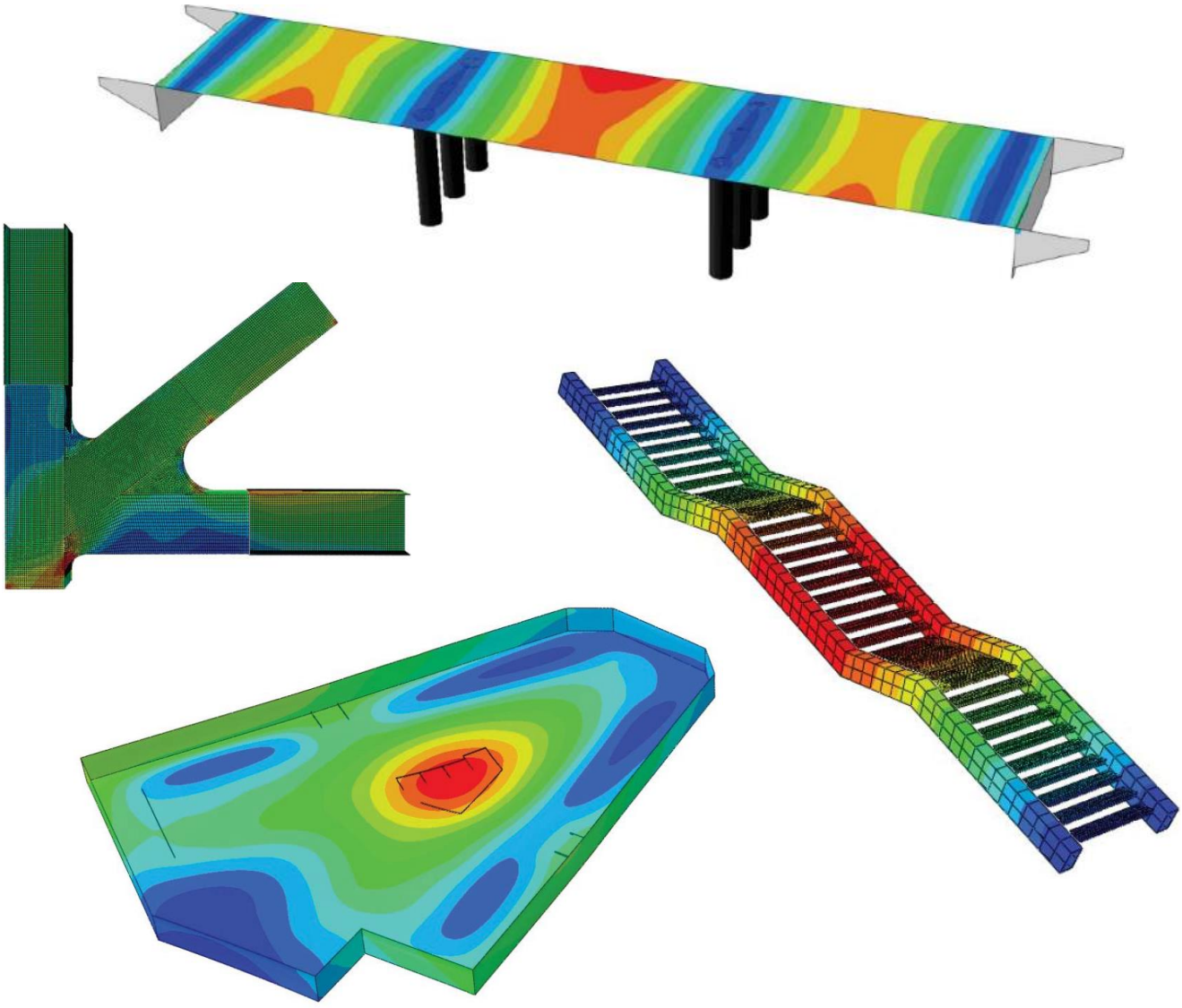
Finite Element Method
- Structural analysis

VSMN30

Course programme 2019



Finite element method – Structural analysis

The course aims at giving the ability to analyse various types of structural problems by means of the finite element method: stresses and strains, 2D and 3D elasticity, beams, plates, isoparametric elements and numerical integration. Design assignments are performed in the course, illustrating the procedure of transferring a design problem into a model suitable for finite element analysis.

Course Plan

Lectures and problem-solving classes are held according to the schedule below.

Note! Lectures are held 8.15-10.00 or 13.15-15 and exercise classes 10.15-12.00 or 15.15-17.

Day	**Room**	**Chapter in "*Introduction to the Finite element method*"**		**Exercise problems**
Wed 6/11 8.15-12.00	V:D V:N2	12	Stresses and strains	12-1, 12-2, 12-3,12-4,12-5
Fri 8/11 8.15-12.00	V:D V:N2	13	Linear elasticity	13-1, 13-2, 13-3,13-4,13-5
Wed 13/11 8.15-12.00	V:D V:N2	15	Approximating functions - vector problems	15-1, 15-2
Fri 15/11 8.15-12.00	V:D V:N2	16	FE formulation of 2D and 3D elasticity	16-1, 16-2, 16-3, 16-4, 16-5, 16-6, 16-7, 16-8
Wed 20/11 8.15-12.00	V:D V:N2	17	FE formulation of beams	17-1, 17-2, 17-3
Fri 22/11 13.15-17.00	V:C V:Dator	18 23, 24	FE formulations of plates **ABAQUS-exercise 1**	18-1, 18-2, 18-3, 18-4
Wed 27/11 8.15-12.00	V:D V: Dator V:N2	18 11, 12	FE formulation of plates **Presentation hand-in assign. 1**	18-5, 18-6, 18-7, 18-8
Fri 29/11 13.15-17.00	V:C V:Dator	19 23, 24	Isoparametric elements **ABAQUS-exercise 2**	19-1

Wed 4/12 8.15-12.00	V:D 20 V:Dator11, 12 V:N2	Numerical integration 20-1, 20-2
Fri 6/12 13.15-17.00	V:C V:Dator23, 24	NL1 Nonlinear material, **Invited lecturer 8.15** **Presentation hand-in assign. 2** **ABAQUS-exercise 3**
Wed 11/12 8.15-12.00	V:D V:Dator11, 12	NL2 Nonlinear geometry
Fri 13/12 8.15-12.00	V:D V: Dator23, 24	NL2 Nonlinear geometry **Hand-in of assign. 1 at 8.15.**
Wed 18/12 10.15-12.00	 V:Dator11, 12	Time for work with assignment
Fri 20/12 8.15-12.00 13.00-15.00	A:B V:O1	**Mandatory seminar.** **Hand-in of assign. 2 at 8.15.** Extra exercise class
Tue 14/1-2019	**Sparta:A,B**	**Exam 8.00-13.00**

Literature

- Ottosen, N.S., Petersson, H.: Introduction to the Finite Element Method, Prentice Hall 1992.
- Olsson, K.-G and Heyden, S.: Introduction to the finite element method, problems, Byggnadsmekanik, Lund 2001.
- CALFEM ver 3.4 - A finite element toolbox to MATLAB, Dep. of Struc. Mech. and Dep. of Solid Mechanics, Lund 1999.

The books are available at KFS. CALFEM manual may be downloaded from the course homepage.

Computer programs

The educational MATLAB toolbox CALFEM will be used continuously during the course. In addition, the commercial FE-code ABAQUS will be used in the course. CALFEM and ABAQUS will be available in the student's computer laboratory.

Hand-in assignments

Two compulsory hand-in assignments are included in the course. 2-3 students work together in a group to solve the assignments and write reports.

The assignments will be judged and awarded maximum 10 points each where 5 points are required for passing. The points will be accounted for in the final grade.

The assignments must be handed in no later than indicated in the course programme. A too late handed in assignment gives maximum 5 points.

The following criteria are used for judging the assignments:
Ability to
- state assumptions,
- perform calculations,
- summarize and draw conclusions,
- limit to important matters and give a proper and logical account of them.

The results of the assignments will be presented and discussed in a mandatory seminar after they have been handed-in.

Invited lecture

An invited lecture is planned in the course. The lecture will be given by a working FE-specialist.

Examination

Along with the hand-in assignments a written examination is given.
The maximum number of points and requirement for passing is given in the following:

	Max. points	Requirement for passing
Written examination	40p	20p

For a final grade it is required that the examination and the hand-in assignments are passed. By summing the points from the examination and the hand-in assignments the final grade is obtained according to the table below:

Points	Grade
30 – 39	3
40 – 49	4
50 – 60	5

Teachers

Kent Persson	046 – 222 81 52	kent.persson@construction.lth.se
Gustaf Larsson	-	gustaf.larsson@construction.lth.se

This programme together with other course information is available on the web at the homepage of the div. of Structural Mechanics: http://www.byggmek.lth.se/