Home Assignment 3

Information

The homework assignments, together with the computer workshops, are compulsory parts of the course. The assignments should be solved in groups of two or three students. The deadline of HW3 is Monday, Oct. 17, 6 pm. A total of 6 points can be obtained on HW3.

Note! If programs like Maple and Matlab are used to solve the homework assignments, print-outs from these programs must only be added as an appendix to the solution. Solutions only consisting of print-outs from Maple/Matlab will be graded with zero points.

Problems

Problem 1. [2 points] On the course home page is now a small FE-program located, `SMALL_FE_PROG.m`. Your task is now to figure out how the program works.

When you study the code, you will see that large parts of it is comments in order to highlight the structure of the program. Some of the comments are missing and your task is to shortly describe what these parts of the code do. A few sentences are enough and you are encouraged to use FEM terminology and mathematical notation. On the cover page, write what you suggest should be the comment and write more explanations on an extra page if necessary.

On the next page, you will find a flow chart with each section having a number which are also written in the code. The four sections of the flow chart marked with **???** is the sections that you should give a comment to.

Flow chart

1 : Reading and checking input.

2 : Setting up vectors and matrices for storing the solution

3 : Looping over all elements

  3.1 : Establish an index-index vector describing the mapping between local and global equation numbers.

  3.2 : **???**

  3.3 : Read the local stiffness matrix for the element $\mathbb{k}_e$.

  3.4 : **???**

  3.5 : Calculate contributions from possible volume forces.

  3.6 : Assembly of element stiffness matrix $\mathbb{K}_e$ into $\mathbb{K}$.

  3.7 : **???**

4 : Prescribed nodal forces are added to $\boldsymbol{F}$.

5 : Establish the reduced equation system ($\mathbb{K}_{red}$ och $\boldsymbol{F}_{red}$) by introducing results of the prescribed degrees of freedom

6 : **???**

7 : Substitute the solution $\boldsymbol{U}_{red}$ into $\boldsymbol{U}$ and calculate $\boldsymbol{F} = \mathbb{K}\boldsymbol{U}$.

8 : Calculate stresses in each element

Problem 2. [4 points] Use a commercial FE software to solve a problem that you define. Present your problem, your model, geometry, boundary conditions and loads on **maximum 2 pages**. I'm not kidding, **you are not allowed** to use more pages. Choose a problem that is not easy to solve by hand and think of which results that could be interesting to show in the report.

Please present the problem with a figure and some describing text. Motivate why you have decided to present the results that you have chosen, and present the results preferably in a figure/graph.

If you want to choose another program than ANSYS/ABAQUS or Comsol, please check with the lecturer Erik Olsson.

Option. Instead, implement a 4-noded isoparametric element in a programming language of your own choice. You should be able to set zero deformation on some DoFs and calculate the stress fields if you apply point forces to some other nodes/DoFs. Here, the code will be the main part of the submission but probably some explanatory text are needed. This task might require more work than the above task but see it then as a good preparation for the exam...

PLEASE DON'T SEE THIS TASK AS A COMPETITION IN WHO WHO COULD SQUEEZE THE LARGEST AMOUNT ON INFORMATION ON TWO PAGES. . . .

Cover page - Home assignment 3

Name and personal registration number (1):

Name and personal registration number (2):

Name and personal registration number (3):

Summarize the answers below:

Problem 1

Fill in your suggestion for the comments in the code

3.2:

3.4:

3.7:

6:

Problem 2

Nothing to summarize.