TU Delft - CIE4180: Plate analysis, theory and applications – 2022/2023 – Assignment 2

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Assignment

A slab has a width and length of $l_1 + l_2 + l_1$ (See figure). The slab thickness is 300 mm. Young's modulus is E = 30 000 N/mm^2 and Poisson's ratio is ν = 0.20. The point support areas are 400 x 400 mm. The load is in the z direction, p = 16 kN/m^2, uniformly distributed. Self-weight is included in this load. The x and y axes are shown in the figure.

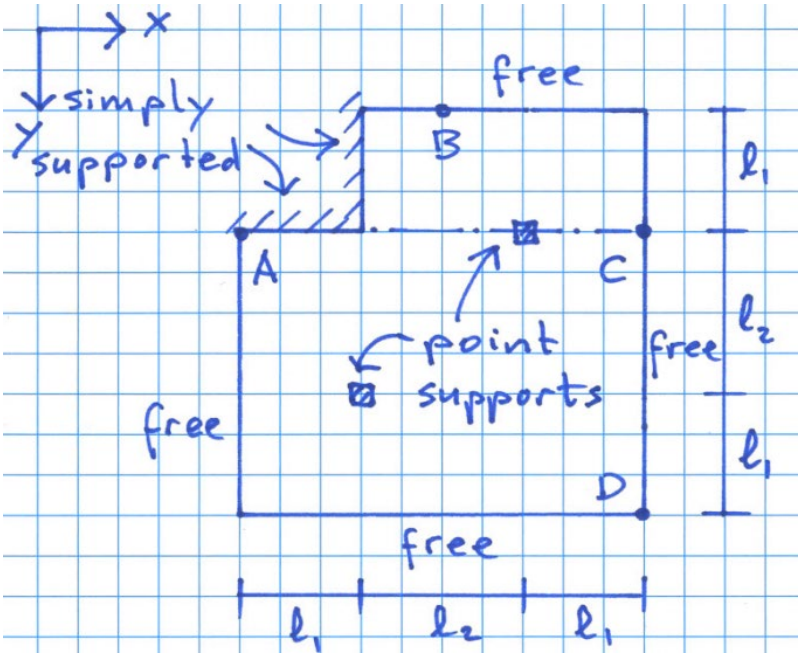

Figure: Slab, dimensions, coordinate system and supports

Finite Element Method (FEM)

Make a finite element model using plate bending elements.

Finite Difference Method (FDM)

Analyse the slab using the finite difference method. Use a spreadsheet, for example MS Excel.
Take ν = 0.

Parameters

Ask the teacher for values of the parameters l_1 and l_2 .

Report

Make a report that includes

- Author, date, TU Delft, CIE 4180 …… 0.1 point
- Introduction, the above figure …… 0.2 point
- Material properties, dimensions, load (Can the results of the report be reproduced?) … 0.2 point
- Kirchhoff or Mindlin-Reissner, element type, element size, explanation of your choices 0.3 point
- Deformed structure (i.e. deformed mesh) …… 0.5 point
- Comments on the deformation (Checking yourself: e.g. deformation is in the right direction, supports work properly, parts are properly connected, …) …… 0.5 point
- Contour plots of the moments m_{xx}, m_{yy} and m_{xy} and shear forces v_x, v_y including color bars …… 1.0 point
- Comments on the moments and shear forces (Checking yourself: e.g. edge value is correctly zero, singularity at …, …) …… 0.5 point
- Graph: The displacement w along line AC …… 0.5 point
- Graph: The moments m_{xx} , m_{yy} and m_{xy} along line AC …… 1.0 point
- In point B, concentrated shear force V and distributed shear forces v_x and v_y …… * …… 0.5 point
- In point C, m_{xx} , m_{yy} and m_{xy} …… * …… 1.0 point
- In point D, deflection w …… * …… 0.5 point
- Point support reaction R …… * …… 0.5 point
- FDM grid size, explanation of your choice …… 0.2 point
- Print screen of the spread sheet …… 1.0 point
- Comments on the FDM results …… 0.5 point
- Comparison of the FEM and the FDM results …… 0.5 point
- Conclusions (e.g. deflection is small and acceptable in most situations, stresses are too large for reinforced concrete, recommended design changes, …) …… 0.5 point

*** Notes for the point results**

Use the sign conventions used in the course (also if the FE software uses a different sign convention). Use the coordinate system in the figure above (also if you use a different coordinate system in the FE model).

Submit

Send your report to the teacher by email. You will receive feedback and a grade.