

Assignment 5

1. Implementation

- A)** Implement your Matlab[®] code to calculate the local stiffness matrix of a 4-node isoparametric element (created in Assignment 4) into the finite element code written in Matlab[®] which is provided in an electronic format.
- B)** Calculate the vertical displacement w at the point 2 for the cantilever beam shown in Figure 1 for the different discretisations of the elements in x -direction and y -direction given in Table 1. Plot the displacements over the number of elements in x -direction and the number of elements in the y -direction. Compare the results with an analytical solution and discuss the convergence. Which of the discretisations reflects appropriately the stresses in the beam?

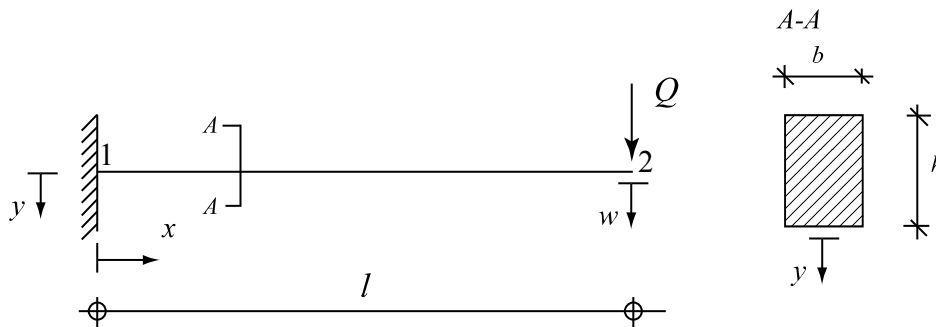


Figure 1: Cantilever beam.

Assume the following properties for the beam and loads:

$$E = 210000 \text{ MPa}$$

$$\nu = 0.3$$

$$b = 40 \text{ mm}$$

$$h = 60 \text{ mm}$$

$$l = 1.0 \text{ m}$$

$$Q = 10 \text{ kN}$$

$$q = 10 \text{ kN / m} \quad (\text{only for C})$$

Table 1: Discretisations of the cantilever beam given in Figure 1.

Number of elements	
y-direction	x-direction
1	4
	10
	15
	20
	32
	128
4	4
	10
	15
	20
	32
	128
8	4
	10
	15
	20
	32
	128

- C) Calculate the displacements at the indicated points (w and u) for the static systems given in Figure 2. Discretise the system into 32 elements in x -direction and 8 elements in y -direction. Compare the results with the analytical solution. Discuss the distribution of the stress in the beam. Describe how you applied the load to the system. Please use the same properties of the beam assumed in B).

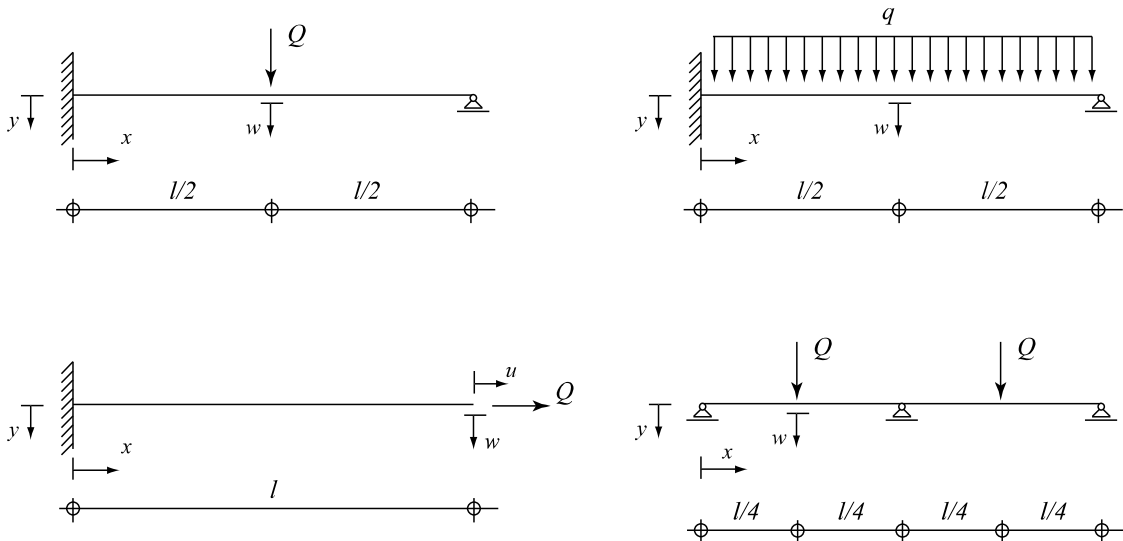


Figure 2: Static systems.