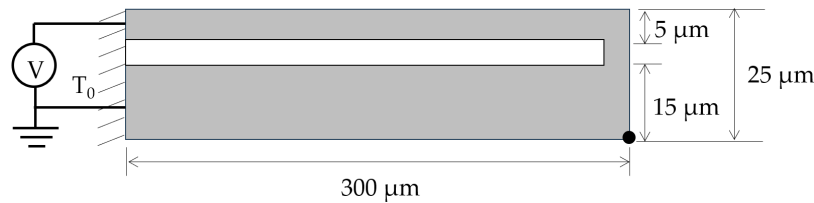


Topology Optimization using COMSOL (8 points)

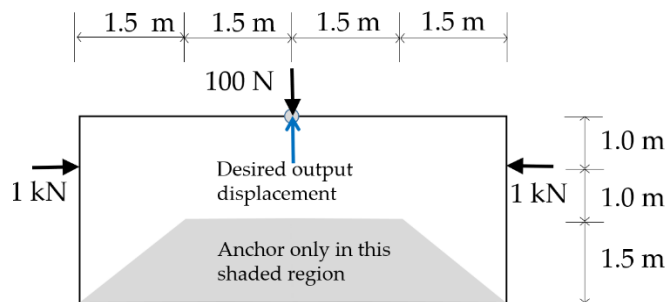
Use COMSOL to solve the two problems.

Problem 1 (8 points)

Verify the analytical design sensitivity derived in Problem 1 of Homework 4 with finite difference sensitivity using COMSOL for the following design domain with and without the white strip in the middle (i.e., without separating the points between which the voltage difference is applied). Use single-crystal silicon properties. Take $V = 10$ V.

**Problem 2 (8 points)**

A 2D domain is shown with design specifications. Find the optimal topology by choosing any anchor boundary conditions of your choice within the shaded domain. Ignore the blue arrow (required displacement) and find the optimal stiff structure by minimizing the strain energy under three loads and for suitable constraints on volume of the material used.



Bonus point 8 if you also design a compliant mechanism that will move up against 100 N load with the same forces. Here, the objective is to maximize the upward displacement at that point under all three loads acting. You should then include a strain energy constraint of twice the strain energy found in the solution of the previous problem.

What to submit for both problems:

Include figures and other details of the examples you tried when you submit in the paper form. Please also submit your files in one zip file by email. **Please name the zip file with your name so that it can be easily traced.**