ME 471/AE 420/CSE 451: PA #7

(Required to students registering for 4 credit-hours)

Due: Monday, May 8, 2017 at 11:59pm **via Compass2g**

Read the attached paper on the course website, download the 99-line Matlab code for topology optimization from *http://www.topopt.dtu.dk/files/top.m* (or copy and paste from the appendix of the paper), and address the following questions:

(a) Explore the effect of filter size *rmin*

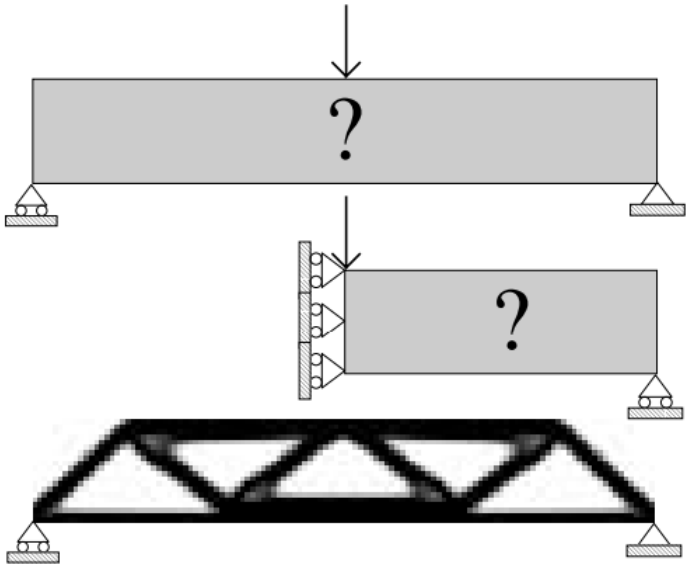

Figure 1. Topology optimization of the MBB-beam (extracted from the paper)

The above figure is the default problem embedded in the Matlab code. As the paper stated, the filtering technique is implemented inside the code to ensure the existence of a solution that is macroscopically feasible and independent of meshes. The parameter of filter size (*rmin*) is set to implement this technique. Please run the default problem (no need to change the code) using the following command:

top(60,20,0.5,3.0,rmin)

with *rmin*=1.0, 1.5 and 5.0, respectively. Show the optimized structures and make comments on the effect of *rmin*.

(b) Explore the effect of the penalization factor. Use the command *top(60,20,0.5,p,3)* and p=1,2,3. What do you observe?

(c) Modify the code to solve the following optimization problem.

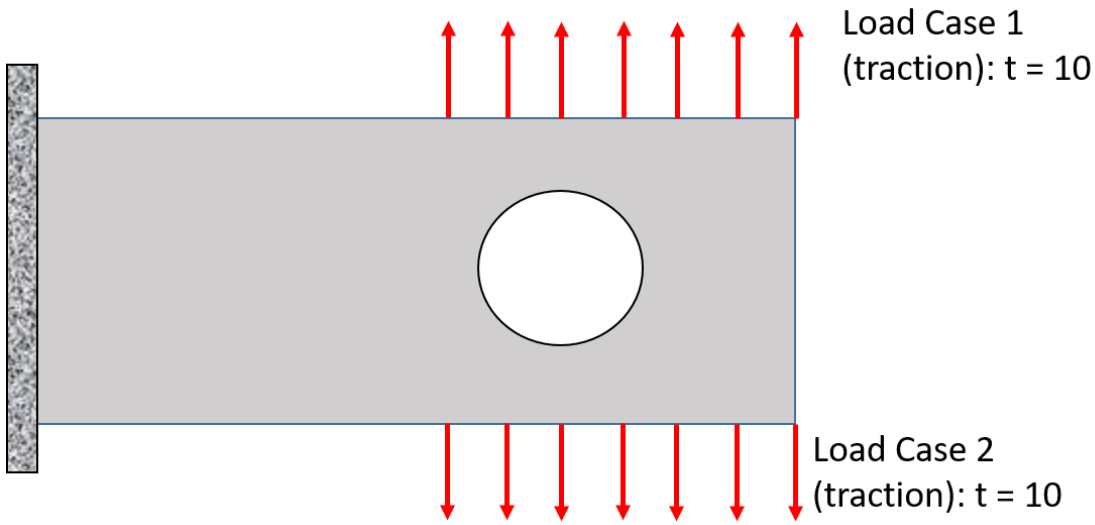

Figure 2. Topology optimization of a cantilever beam with a hole under 2 different load cases

Conditions:
(1) A cantilever beam of length L with left end clamped.
(2) Two different load cases. Load case 1 is a distributed load with the value of 10 exerted at the upper surface, from x = L/2 to x = L. Load case 2 is a distributed load with the same magnitude of 10, but opposite direction, exerted at the lower surface, from x = L/2 to x = L.
(3) There is a hole with the center located at (2*nelx/3, nely/2) and radius of nely/3.

Following the instructions in the paper, make corresponding modifications to the code and run with the command:

top(90,40,0.5,3.0,1.5)

Show the optimized structure and attach your modified code.