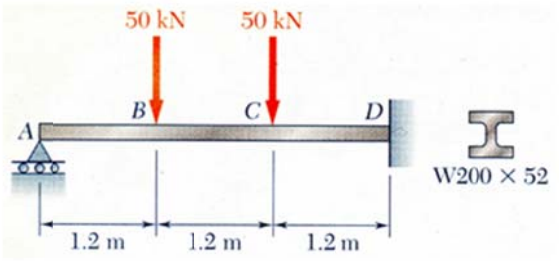
Final Exam - Lab

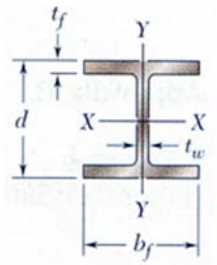
12/15/2016

Submit the compressed file as `(ID)_(name).zip` to [ftp://cdl.hanyang.ac.kr → CAE/Final_Lab] folder. It should contain the final results of each problem (equations and graphs) using PowerPoint (`ID.ppt`) and COMSOL files (`problem#-#.mph`).

1. [Deflection of beam] For the beam and boundary conditions shown, compute the deflection at point B.
   1) Use 2D beam module. (The number of elements is 30) (10 pts)
   2) Use 3D solid mechanics module. (mesh option : normal) (10 pts)

Analytic solution : $d_B = 3.19\,mm$



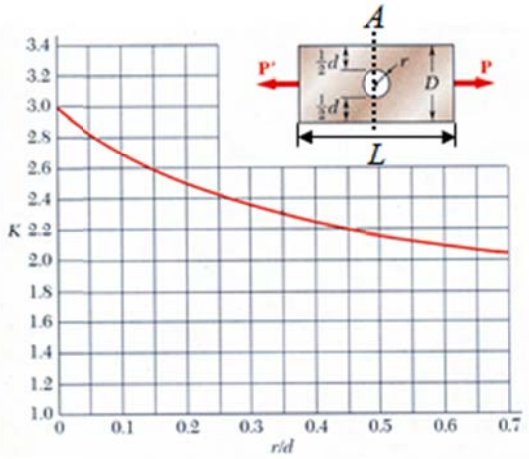


$E = 200\,GPa,\ \nu = 0.33$

$d = 206\,mm, b_f = 204\,mm$

$t_f = 12.6\,mm, t_w = 7.9\,mm$

2. [Stress concentration] The following flat bar with hole has a thickness of 1 m. (left side is fixed.)



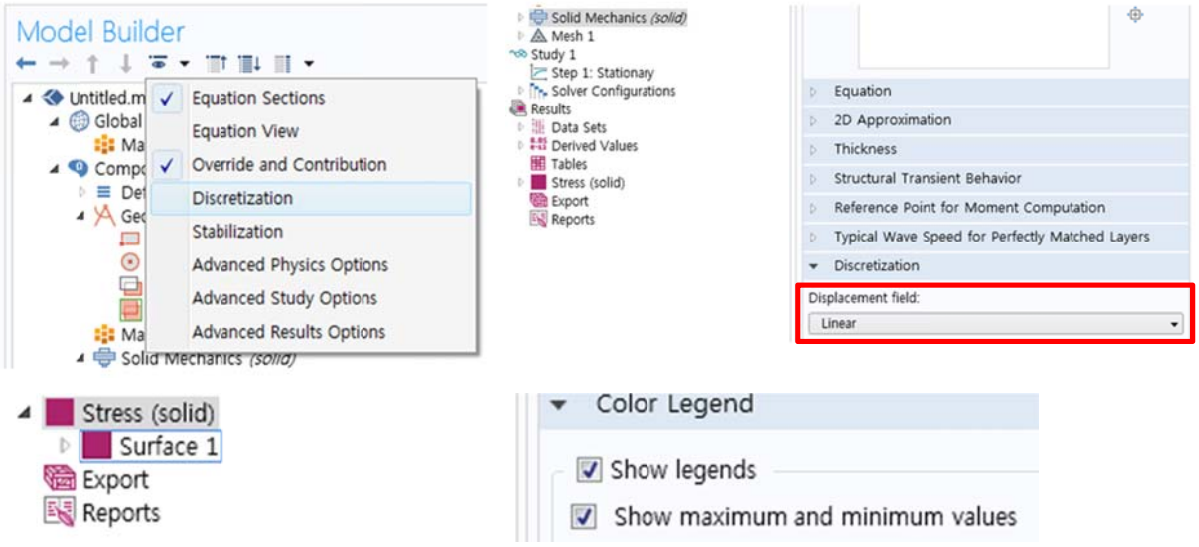
$E = 200\,GPa,\ \nu = 0.33$

$L = 5\,m, D = 2\,m,\ P = 200\,N$

$\sigma_{ave} = \frac{P}{A},\ K = \frac{\sigma_{max}}{\sigma_{ave}}$

r [m]	0.5	0.4	0.3	0.2
r/d	0.5	0.333	0.214	0.125
K	2.18	2.30	2.46	2.62

(1) Compute the maximum normal stress(`solid.sx`) with r = 0.5 m. Check the stress by mesh dependency applying free triangular and quad elements(linear). Plot the graph as d.o.f vs stress changing mesh size with two cases.(mesh option : normal ~ extremely fine) (15 pts)



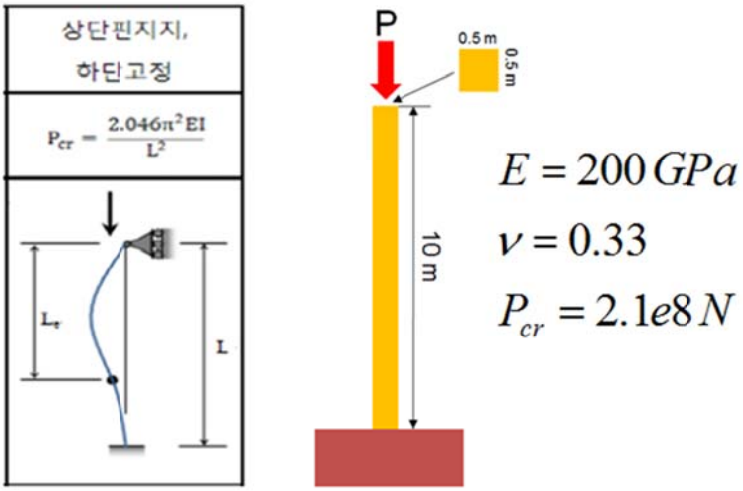
(2) Compute the value of K changing the radius(0.2 ~ 0.5 m). Compare the value of K on table with computing result from FEM. (mesh option : quad & extremely fine) (15 pts)

(3) Construct the quarter model and check the maximum stress with r = 0.5 m. Compare the quarter model with full model. (10 pts)

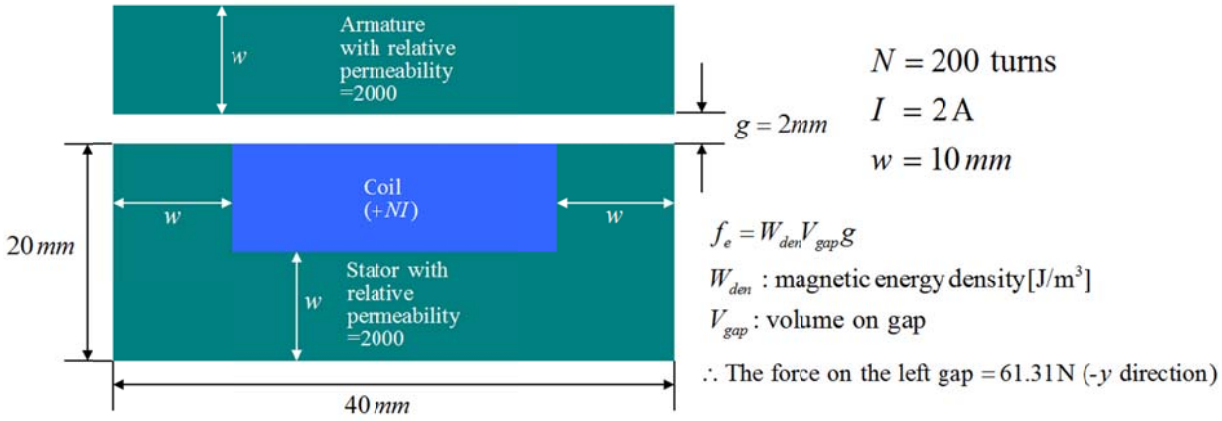
3. [Linear buckling] For the column and boundary conditions shown, compute the critical load for the column.

1) Use 2D solid mechanics module. (8 pts)

2) Use 3D solid mechanics module. (8 pts)



4. [Magnetic actuator] For the actuator and boundary conditions shown, assume that the magnetic energy density(`mf.Wm`) among the gap is constant.(use 1D plot group → Line graph)



1) Compute the magnetic force on the left gap.(mesh option : free triangular) (14 pts)

2) Applying the mapped mesh(20x4) on the gap and compute the magnetic force.(apply free quad mesh on the other region) (10 pts)