Final Exam - Lab

06/13/2013

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

1. (25 pts) Model the infinite plate in a 2D plane stress approximation as a 2 m by 2 m plate with a hole with a radius of 0.1 m in the middle. The material is the isotropic material where E = 2.1e11 Pa and ν = 0.3. A distributed stress of 10e3 Pa on the right and left edge pointing in the x and −x direction, respectively. Perform the finite element analysis

(1) Using a full model.
(2) Using a quarter model.
(3) Graph the x-direction stress at the middle vertical line and discuss the result.

2. (25 pts) Model the 10 m tall hollow cylinder as the inner and outer radius are 1.8 m and 2.2 m, respectively. The material is isotropic material where E = 2.01e11 Pa, ν = 0.3. Find the natural frequencies and their mode shapes from 1st to 6th order by performing the finite element analysis

(1) Using a 3D model.
(2) Using a axis-symmetry model.
(3) Discuss the result.

3. (25 pts) Model the 0.4 m tall cylinder as the radius is 0.3 m. The material is isotropic material where the density is 7850 kg/m^3, the heat capacity 460 J/(kg°C), and the thermal conductivity is 52 W/(m°C). The outer boundaries have a temperature of 1000°C and the entire domain is at 0°C at the start. Perform the transient heat transfer analysis

(1) Using a 3D model.

(2) Using an axis-symmetry model.

(3) Find the temperature at the target location (where the radius is 0.1 m and 0.3 m tall) when the time is 190 seconds. Discuss the result.

4. (25 pts) This problem is intended to address the questions of force calculations as well as modeling of coil and permanent magnets in axisymmetric. The magnet and coil are shown in Figure 1. The coil is wound on a nonmagnetic form (brass in this case) with dimensions given in Table 1.

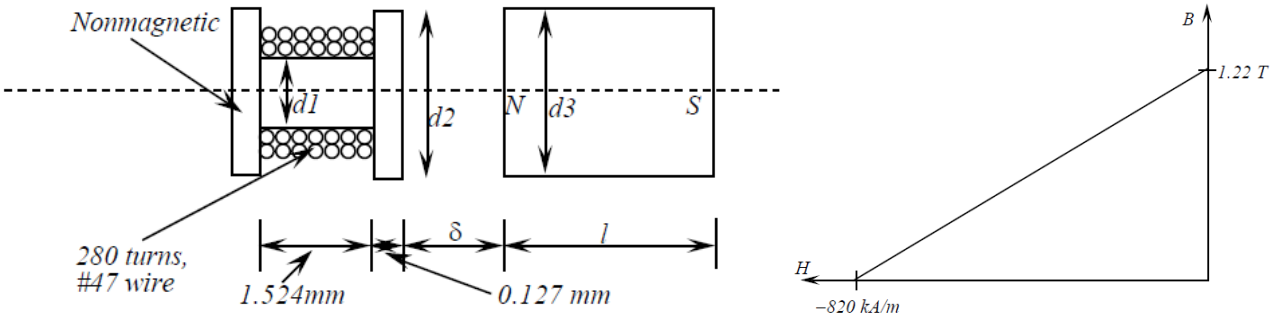

Figure 1. Configuration for axial force measurement and demagnetization curve for magnet.

Table 1. Dimensions

d_1	d_2	d_3	l	coil res.	wire length
3.048	3.9624	2.9972	1.6	57Ω	3m

At δ = 0.254 mm, graph the axial force between magnet and coil when the current varies from 0 to 100 mA and discuss the result.