School of Civil & Environmental Engineering
Seoul National University
Kwanak-Gu, Seoul 151-742, Korea

Mid-term Exam II, Theory of Elasticity

2017. 5. 15.

(Closed everything.)

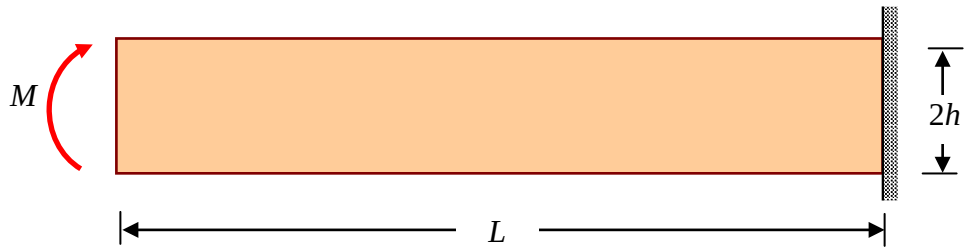
Prob. 1 Derive the path independency condition of the displacement field of 3-D solids. You don't need to show the Saint Venant's compatibility conditions. (20 pts.)

Prob. 2 Prove the dependency of compatibility equations presented by Prof. Washizu and explain its physical meanings. Bianchi formulas are given as follows. (20 pts)

$$\frac{\partial R_1}{\partial x_1}+\frac{\partial U_3}{\partial x_2}+\frac{\partial U_2}{\partial x_3}=0\,,\quad \frac{\partial U_3}{\partial x_1}+\frac{\partial R_2}{\partial x_2}+\frac{\partial U_1}{\partial x_3}=0\,,\quad \frac{\partial U_2}{\partial x_1}+\frac{\partial U_1}{\partial x_2}+\frac{\partial R_3}{\partial x_3}=0$$

Prob. 3 Express Lame's constants in terms of the Young's modulus and Possion's ratio using fundamental Hooke's law and Possion's phenomenon. Derive the shear modulus from the physical point of view. (20 pts.)

Prob.4 Answer the following questions on the cantilever beam shown below.



a) Specify the boundary conditions. In case an approximate boundary condition is adopted for the bending moment, you have to justify the approximation in detail. (5 pts.)

b) Assume proper stress components, and show that your stress components satisfy the compatibility condition. (10 pts.)

c) Calculate the displacement components based on the stress assumed in b), and explain whether the calculated displacement field can satisfy the displacement boundary condition given in a). If not, explain why. Suggest a possible displacement boundary condition for your stress components, and derive the displacement field corresponding to the assumed boundary condition. (20 pts.)

Hae Sung Lee, Professor, Structural Analysis Lab
Tel : +82-2-880-8388 , Fax : +82-2-887-0349, e-mail : chslee@snu.ac.kr