

Mid-term Exam 1, Theory of Elasticity

2017. 4. 10.

(Closed everything, and answers may be given in Korean or English.)

Prob.1 The principle of Archimedes defines the buoyant force of a body submerged in fluid, which is induced by the pressure of the fluid acting on the boundary of a body. Calculate the total resultant forces and moments acting on a completely submerged body in fluid for all directions. Assume that there is no body force, moment and inertia force and that the fluid is incompressible and inviscid (no viscosity). You have to specify which equations in your derivation are based on the aforementioned assumptions on the characteristics of the fluid. The specific weight of the fluid is γ . (Hint: Define the pressure acting on the boundary in each direction and apply the divergent theorem.) (20 pts)

Prob.2 Define the elasticity problems for three-dimensional solids from the mathematical point of view in case no body moment and inertia force exist. Do not physically define your variables except the surface traction and body force. Start your formulation from the fundamental statement of the equilibrium. (30pts)

Prob. 3 State the four axioms used in the solid mechanics. Explain the mathematical significance of the axiom on the relation between stress and strain. (10 pts)

Prob. 4 Derive the acceleration defined by Sir Isaac Newton for one dimensional problems in terms of the velocity field given by the Eulerian description. (10 pts)

Prob. 5 Express the Green strain and the Cauchy's infinitesimal strain in terms of the displacement field. (10 pts.)

Prob. 6 Explain the physical meanings of the Cauchy's infinitesimal strain based on the definitions of the Green's strain. (20 pts.)