

Mid-term Exam 1, Theory of Elasticity

2015. 4. 13.

(Closed everything, and all answers should be given in English.)

Prob. 1. Prove the divergence theorem in the three dimensional Cartesian coordinate space (10pts).

Prob. 2 Define a continuous set and a continuous distribution in a mathematical sense (10pts).

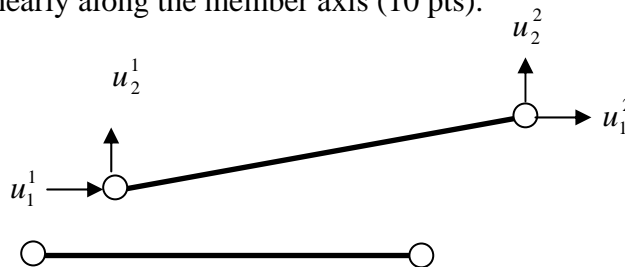
Prob. 3 State the four axioms used in the theory of elasticity. Explain the consequence of the 4th axiom on the stress-strain relation in detail (15 pts).

Prob.4 Derive the equilibrium equation for three dimensional elastic body in terms of displacement from purely mathematical point of view based on the potential theory. Discuss why the potential theory should be applied in your formulation? Also give detailed explanations on the relations between your potential functions and the stress tensors (20pts).

Prob. 5 Discuss whether statically determinant problems may exist in the general 3-dimensional elasticity problems (10 pts).

Prob. 6 Explain the Eulerian and Lagrangian kinematic description in detail, and derive the acceleration for a fixed material particle in the one-dimensional problem for Eulerian description (15 pts).

Prob. 7 Derive the Green's strain for a plane truss member ($u_3=0$) shown below. Assume that displacements vary linearly along the member axis (10 pts).



Prob. 8 The general compatibility equations for 3-dimensional elasticity problems are derived from the path-independent requirement of displacement field. Explain why the displacement field should be path-independent (10pts).

Answers given in languages other than English are not considered at all for scoring!