Introduction to the theory of elasticity 0542-4221
Week by week syllabus
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Lecture schedule:

- Week 1: The stress tensor, equilibrium eqs. derivation, transformation of coordinates of a 2nd order tensor, principal stresses and stress tensor invariants.

- Week 2: Kinematic relations between strains and displacements. Derivation of the Green and Almansi strain tensors (finite strains). The small strain tensor and the compatibility equations. The physical interpretation of shear strain and normal strain.

- Week 3: Constitutive law – Hooke's law for a general anisotropic material, and Isotropic materials. The Lamme constants, Young modulus and Poisson's ratio – Incompressible materials.

- Week 4: The Navier-Lamme equation, Saint-Venant principle and the superposition principle. Two dimensional problems – Generalized plane-strain, and the Navier-Lamme equations for plane strain.

- Week 5: The Airy stress function for 2-D isotropic material under pl. stain: derivation based on compatibility equation, and equilibrium equation. Examples of Airy S.F. in a rectangle.

- Week 6: Plane stress – the Navier-Lame equations, the Airy stress function. Example of the Airy Stress function for solving the cantilever beam with an end shear force.

- Week 7: Stress and strains in a Cylindrical coordinate system. Derivation of the equilibrium equations in cylindrical coordinates. Plane strain and plane stress problems of 2-D bodies of circular shapes, independent of \theta.

- Week 8: Solution of circular bodies problems in cylindrical coordinates: cylinder and disc under internal and external pressure (plane stress/strain).

◻ Week 9: Cylinder/disc rotating with constant angular velocity. The Airy stress function in cylindrical coordinates.

◻ Week 10: Equations of elasticity in axi-symmetric domains. Introduction to thermo-elasticity.

◻ Week 11: Formulation of the uncoupled Thermo-Elastic problem in 3-D domains. Plane-stress and plane-strain situations of a thermo-elastic problem. Solution of a plane-stress thermo-elastic disk under constant temperature field.

◻ Week 12: Solution to HW problems and solving one of the previous year's test.

◻ Week 13: Elastic solution in the neighborhood of singular points in 2-D elasticity. Eigen-pairs and the Airy stress function for singular solutions, and the asymptotic series.