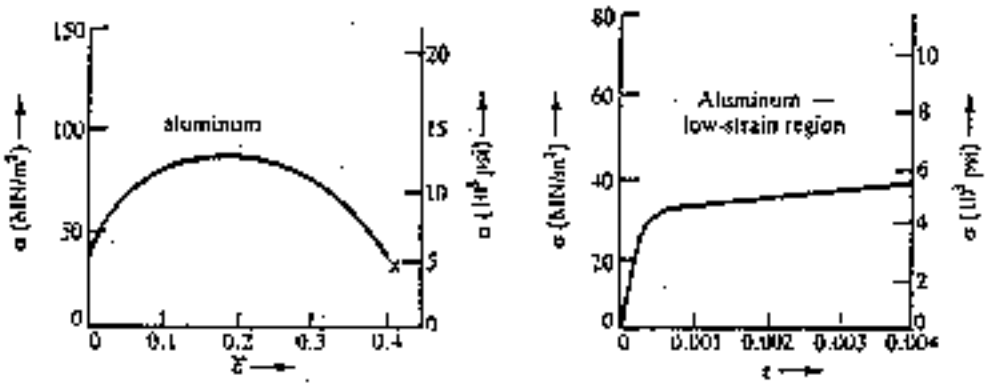
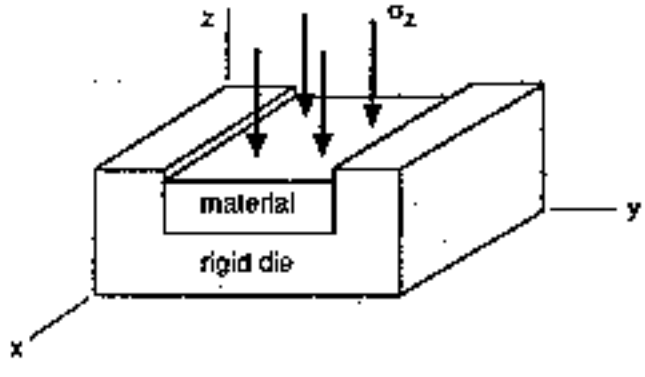
1. (30pts) Please define the following terms:
   (a) dilatation,
   (b) brittle material,
   (c) shearing strain,
   (d) anisotropic material,
   (e) Tresca's yield criterion,
   (f) plastic section modulus,
   (g) shear center,
   (h) von Mises yield criterion,
   (i) strain rosette,
   (j) modulus of resilience.

2. (15pts) The tensile stress-strain behavior of pure aluminum is shown in the graphs below. Determine approximately the following properties for pure aluminum. (a) Young's modulus (a) 0.2% offset yield strength, (c) ultimate stress, (d) fracture stress, (e) percent elongation.



3. (20pts) A sample of material subjected to a compressive stress σ_z is confined so that it cannot deform in y-direction (shown below), but deformation is permitted in x-direction Assume that the material is isotropic and exhibits linear-elastic behavior. The Young's modulus is denoted as E and the Poisson's ratio is v. Determine the following in terms of σ_z, E and v:
   (a) The stress that develops in the y-direction.
   (b) The strain in the z-direction.
   (c) The strain in the x-direction.
   (d) The stiffness $E' = \sigma_z/\varepsilon_z$ in z-direction. Is E' equal to E from a uniaxial test on the material? Why or why not?



(背面仍有題目,請繼續作答)

4. (15pts) Consider a thin-walled tube with closed ends and internal pressure p. The wall thickness is t and the inner radius is r, and the ductile material has an ultimate strength σ_u. Derive an equation for the required thickness corresponding to specified values of r and the safety factor X against ultimate strength.

5. (20pts) For the cantilever beam shown, determine (a) deflection at end B, (b) the bending moment diagram of the beam (E = Young's modulus and I = moment of inertia).