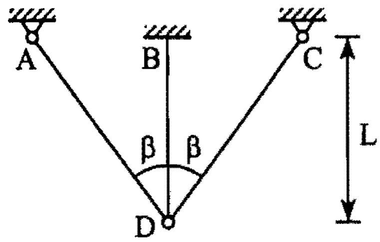
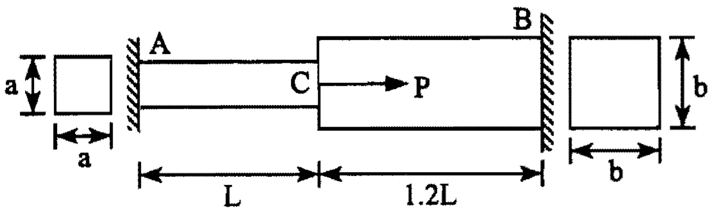
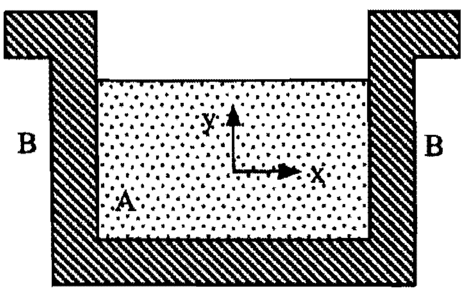
1. A three-bar truss is assembled at room temperature as shown. All the members have the same modulus of elasticity E, cross section area A, moment of inertia I and thermal expansion coefficient α. After the assembling, the temperature of member BD is increased by ΔT. However, the temperature of members AD and CD are not changed. Find the maximum value of ΔT in order to avoid the buckling of member BD. (20%)



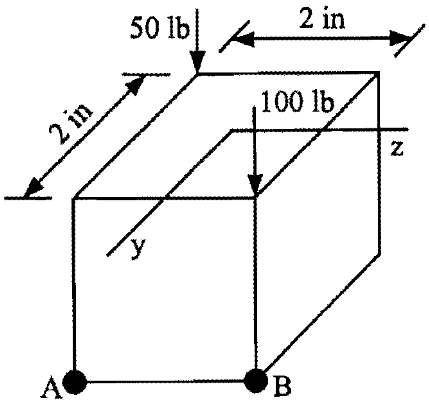
2. A nonprismatic member ACB is fixed at both ends as shown. There is a concentrated force P applied at point C. Assume the member is made of an elastic-perfectly plastic material with the yield stress $\sigma_y = 200$ MPa. If $a = 15$ cm for member AC, $b = 20$ cm for member CB and L= 2 m, calculate the ultimate load P_u that can be applied to the member. (15%)



3. A block of material A with modulus of elasticity E, Poisson's ratio ν and thermal expansion coefficient α is confined between rigid walls B in x direction and is not confined in the y and z directions. If the temperature of the material is increased by ΔT. Disregard friction between the material and the walls. Calculate (i) the lateral pressure σ_x between the material and the rigid walls, (ii) the unit volume change e of the material, (iii) the strain energy density u of the material. (25%)



4. A block is subjected to two axial loads. Determine the normal stress at points A and B. (20%)



5. Please explain how to determine the distances e_1 and e_2 for the shear center S of a thin-walled beam having the cross section shown below. (20%)