1. A thin plate with cross section A had been set up in the laborotory, as shown in Fig 1, to study its strain field. An environmental cottrolled chamber is used to heat up the plate up to $T_o + \Delta T$ where T_o is the room temperature. Find the strain field in the center of the plate under elastic condition.

(15Pt)

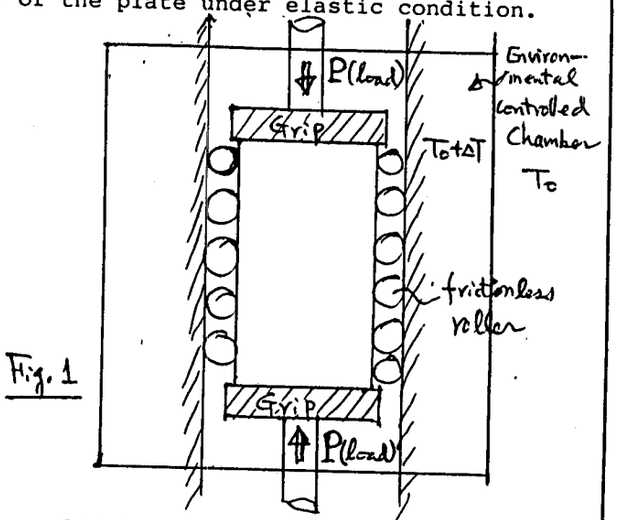


Fig. 1

2. A belt of tension force F acting on a solid tapered shaft AB as shown in Fig 2. To determine the magnitude of F, one measures the twist angle Φ_A at A. (a) Find the exact solution of Φ_A. (b) If one use mean radius of the shaft as an approximation, what is the error % in Φ_A ? (c) If the shaft is designed to perform its function without yielding, what is the allowable force F if the value of factor of safety is n , and the maximum shear stress theory is used ? Notice in (a) (b) and (c) the material behavior is purely linear elastic and L = 10C .

(a)10Pt
(b) 5Pt
(c)15Pt

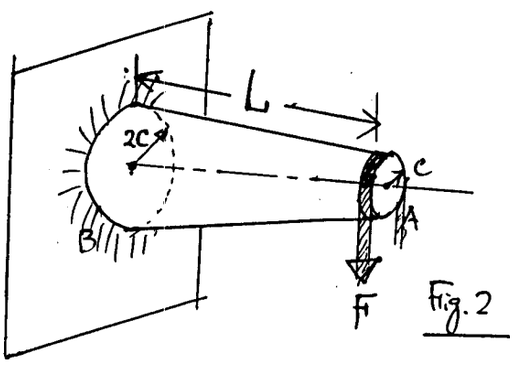
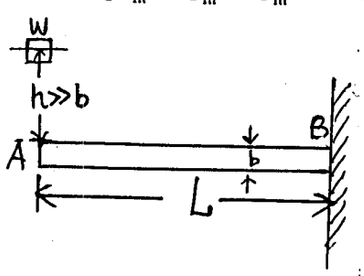


Fig. 2

3. A block of weight W is dropped from a height h onto a horizontal beam AB and hits it at point A. (a) Find the maximum deflection y_m can be expressed by $y_m = y_{st}(1+\sqrt{1+ 2h/y_{st}})$ where y_{st} is the deflection of A caused by a static load W. (b) If one neglect the effect of deflection on the change in potential energy of the block, one obtain a maximum deffection at A, y'_m . Show that the absolute value of the relative error $(y'_m - y_m)/y_m$ never exceeds $y'_m/2h$.

(a)15Pt
(b)10Pt



4. The cantilever beam AB consists of half of a thin-walled pipe of mean radius $\bar{r}$ and thichness t . Knowing that the vertical load P passes through the centroid C of the cross section of the beam, determine (a) the location of shear center, (b) the torque which cause the beam to twist in the same way that it does under the load P, (c) the maximum shearing stress in the beam.

(a)15Pt
(b) 5Pt
(c)10Pt