（乙組）

1. A bar, attached to two rigid walls at A and C, has the dimensions and 20% stress-strain behavior as shown. The bar is loaded at B with a load $P = 234$ kips. Determine

(a) The distance through which point B moves.

(b) The reactions R_A and R_C.

(c) Maximum load P which can be applied to the bar.

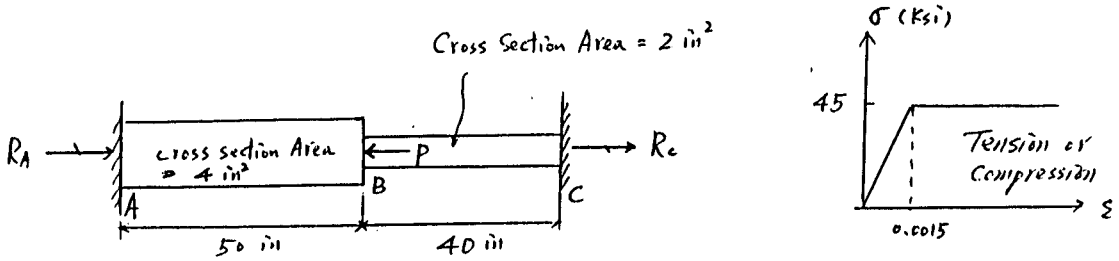


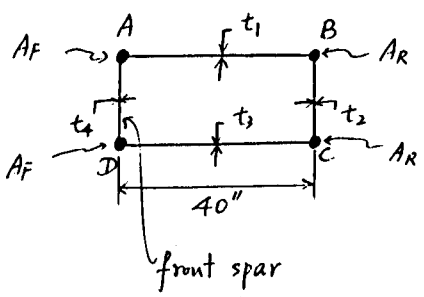
Figure 1

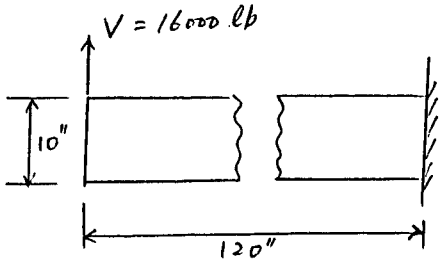
2. The wing box beam shown in Figure 2 has front spar-flange areas (A_F) which 20% are 3 times the rear spar-flange areas (A_R). The beam is supposed to resist a maximum vertical load $V = 16000$ lb.

(a) Find the shear center.

(b) If V is applied at point A, find the angle of twist at the free end ($G = 4.0 \times 10^6$ lb/in²).

Assume the thin webs to be ineffective in resisting bending.





$A_F = 3A_R$

$t_1 = t_3 = 0.04"$

$t_2 = 0.032"$, $t_4 = 0.081"$

Figure 2

3. Cantilever beam AB supports a load $P = 50$ lb as shown in Figure 3. 20% A simply supported beam CD is attached to the end of cantilever beam AB and supports a load of 30 lb/ft. Determine the deflection δ of point B. The beams have the same section and the same modulus of elasticity.

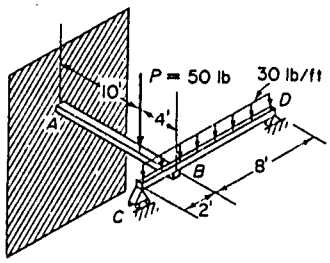


Figure 3

4. (a) What is 'Buckling'? Is it a nonlinear or linear problem? Why? 20% (b) Find the buckling load for the following system.

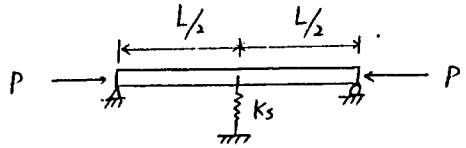


Figure 4

5. A 45° strain rosette consists of three electrical-resistance strain gages 20% arranged as shown in Figure 5. Gages A, B, and C measure the normal strains ϵ_a, ϵ_b and ϵ_c in the directions of lines Oa, Ob and Oc, respectively. Determine the principal stresses in terms of Young's Modulus E, poisson's ratio ν, and the normal strain ϵ_u, ϵ_v, if $\epsilon_a = \epsilon_c$, $\epsilon_b > \epsilon_a$.

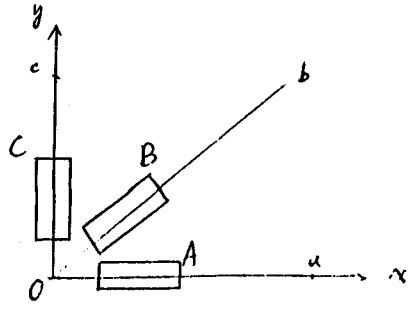


Figure 5