

1. A  $45^\circ$  strain gage rosette (Figure 1) mounted on the surface of a steel plate gives the following readings:

$$\epsilon_A = 500 \mu\epsilon,$$

$$\epsilon_B = 300 \mu\epsilon,$$

$$\epsilon_C = -80 \mu\epsilon$$

- (a) Determine the principal strains and the angle of the first principal strain associated with x-axis.
- (b) Use the principal strains obtained in (a) to determine the principal stresses and maximum shear stress  $\tau_{\max}$  exerted on the steel plate if the Young's modulus  $E=60$  GPa and Poisson's ratio  $\nu=0.3$ .  
If you cannot solve (a), please assume  $\epsilon_1 = 600 \mu\epsilon$  and  $\epsilon_2 = -200 \mu\epsilon$  to determine principal stresses and  $\tau_{\max}$ . (20%)

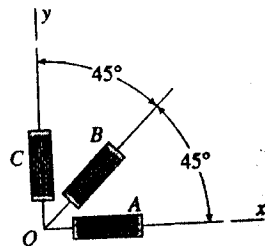


Figure 1

2. A solid circular shaft whose diameter is 50 mm is subjected to a torque of 500 N-m and two components of transverse shear force at its free end as shown in Figure 2. The other end is fixed.
- (a) Find the stress state on the surface of the shaft at point A, also show your solution on a stress block.
- (b) Use a Mohr's circle to determine the principal stresses and the maximum shear stress at point A. (20%)

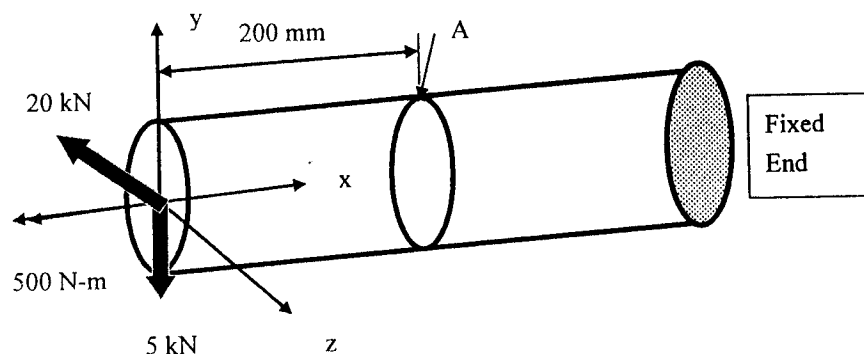


Figure 2