

Problem Session #3

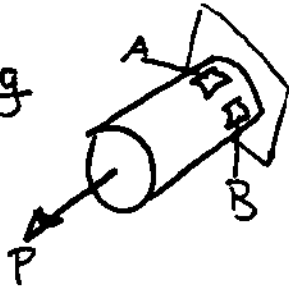
Stresses

Stresses come from 4 loading conditions:

- Axial Loading
- Bending Moment
- Torsion
- Shear

Axial Loading

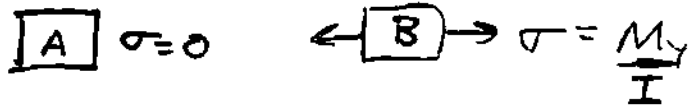
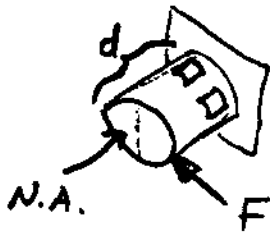
$$\sigma = \frac{P}{A}$$



Bending Moment

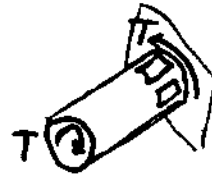
$$\sigma = \frac{My}{I}$$

M = moment
y = distance from neutral axis
I = moment of inertia



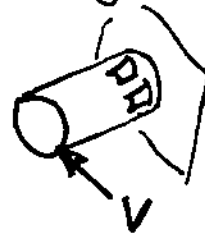
Torsion

$$\tau = \frac{Tr}{J} \quad (\text{for circular rods})$$



Shear

$$\tau = \frac{4V}{3A} \quad (\text{for circular rods})$$



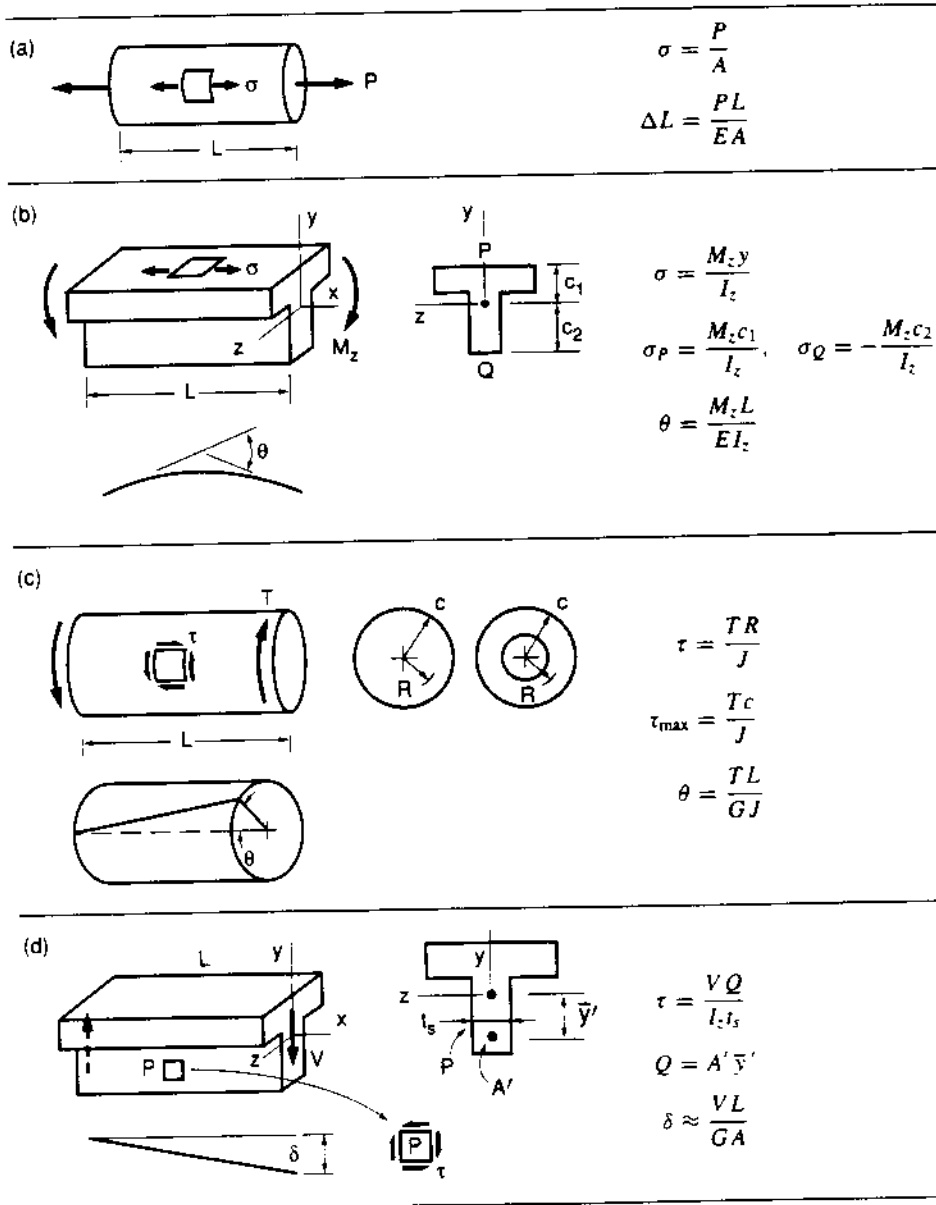
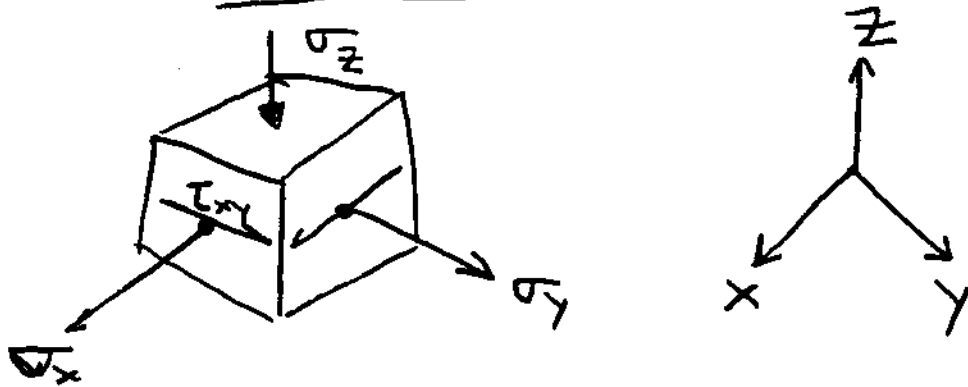


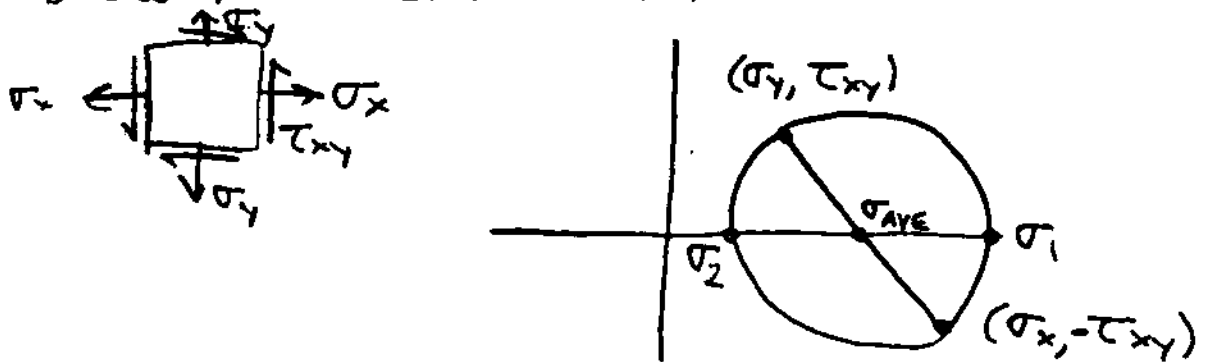
Figure A.1 Equations for calculating stresses and deflections for (a) centric axial loading, (b) symmetric bending, (c) torsion of circular shafts and tubes, and (d) transverse shear.

3-D Mohr's Circle



How to find principal stresses and maximum shear:

- ① Draw Mohr's Circle in XY Plane



- ② Find principal stresses in XY plane

$$\sigma_1 = \sigma_{AVE} + \left[\left(\frac{\sigma_x - \sigma_y}{2} \right)^2 + \tau_{xy}^2 \right]^{\frac{1}{2}}$$

$$\sigma_2 = \sigma_{AVE} - \dots$$

- ③ Add in point for third dimension

