Problem Session #3

Stresses

Stresses come from 4 loading conditions:
- Axial Loading
- Bending Moment
- Torsion
- Shear

Axial Loading
\[ \sigma = \frac{P}{A} \]

Bending Moment
\[ \sigma = \frac{M_y}{I} \]

Torsion
\[ \tau = \frac{T}{J} \] (for circular rods)

Shear
\[ \tau = \frac{Q}{\frac{3}{2}A} \] (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

   \[ \sigma_1 = \sigma_{\text{AVE}} + \left( (\sigma_x - \sigma_{\text{AVE}})^2 + (T_{xy})^2 \right)^{\frac{1}{2}} \]
   \[ \sigma_2 = \sigma_{\text{AVE}} - \ldots \]
   \[ \sigma_3 \]

2. Find principal stresses in XY plane

3. Add in point for third dimension