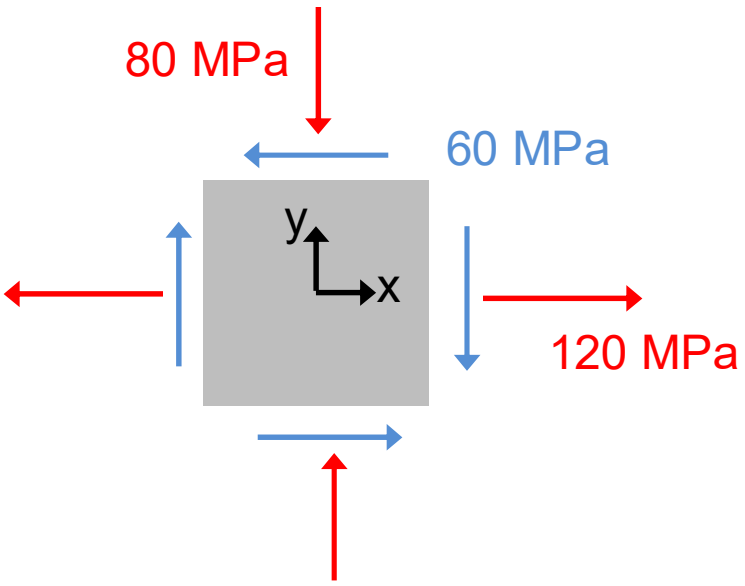
Lecture 38 Quiz: Practice with Failure



A stress element is subjected to the loading shown above.

a) If the material is made of ductile steel with a yield stress (σ_Y) of 150 MPa, does the MSS predict failure?

b) If the material is made of brittle steel with $\sigma_{UC} = 150\ MPa$ and $\sigma_{UT} = 150\ MPa$, will the structure fail?

$\sigma_{avg} = \frac{120-80}{2} = 20\ MPa$

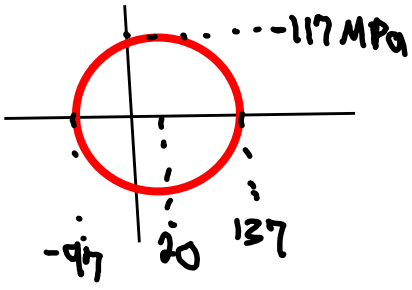
$R = \sqrt{\left(\frac{120+80}{2}\right)^2 + 60^2} = 117\ MPa$

$\sigma_{P1} = 137\ MPa \qquad \sigma_{P2} = -97\ MPa$

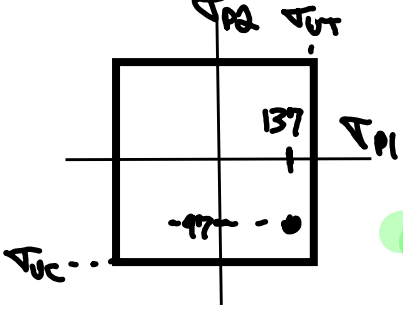
$\tau_{max,abs} = R = 117\ MPa$

a) $\tau_{max,abs} = 117\ MPa > 75\ MPa = \frac{\sigma_Y}{2}$

$\Rightarrow$ MSS predicts failure



b) When $|\sigma_{UC}| = |\sigma_{UT}|$



$|\sigma_{P1}| < |\sigma_{UT}|$

$|\sigma_{P2}| < |\sigma_{UC}|$

$\Rightarrow$ no failure