

# Summary: Stress-based failure theories

**PROBLEM:** Given a state of plane stress, with the xy-components of stress given by:  $\sigma_x$ ,  $\sigma_y$  and  $\tau_{xy}$ . What is the factor of safety for this state of stress?

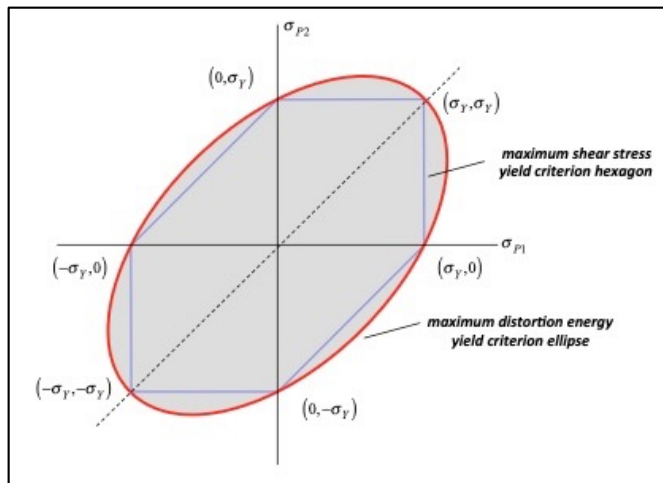
## DUCTILE material w/ yield strength $\sigma_Y$

- Maximum shear stress theory (MSS)

$$FS_{MSS} = \frac{\sigma_Y/2}{\tau_{max,abs}}$$

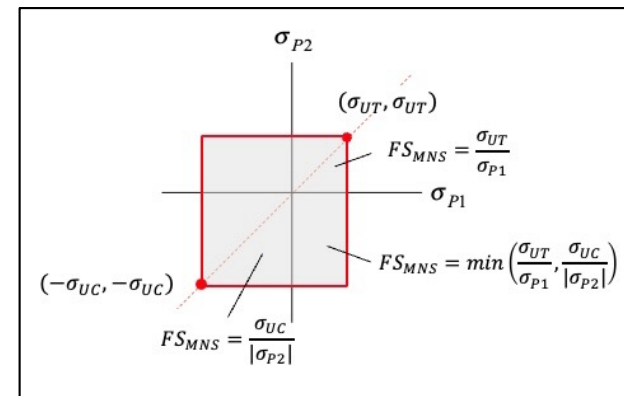
- Maximum distortional energy (MDE)

$$FS_{MDE} = \frac{\sigma_Y}{\sqrt{\sigma_{P1}^2 - \sigma_{P1}\sigma_{P2} + \sigma_{P2}^2}}$$



## BRITTLE material w/ ultimate strengths $\sigma_{UT} < \sigma_{UC}$

- Maximum normal stress theory (MNS)



- Coulomb/Mohr theory

