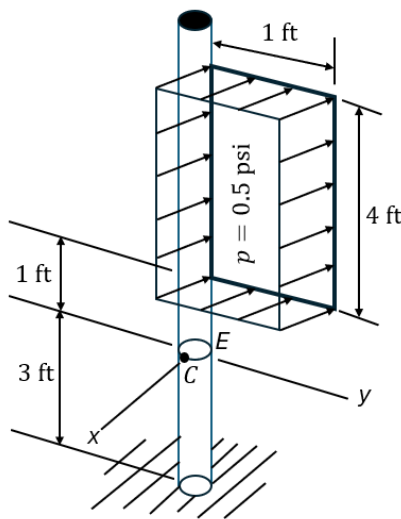
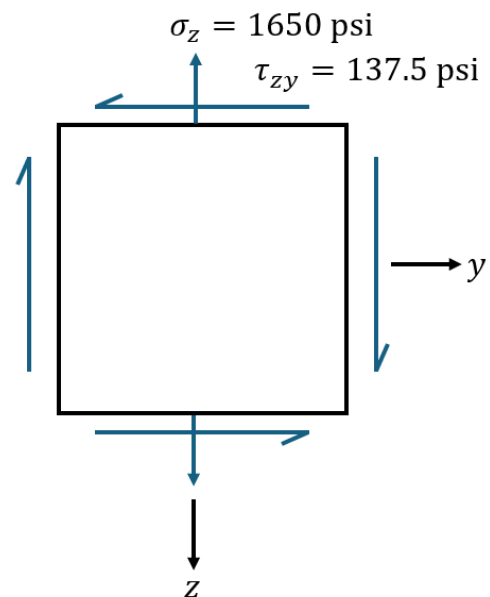


INSTRUCTIONS:

This quiz is open-book and open-note. Please answer all questions and show all of your work.

GIVEN:

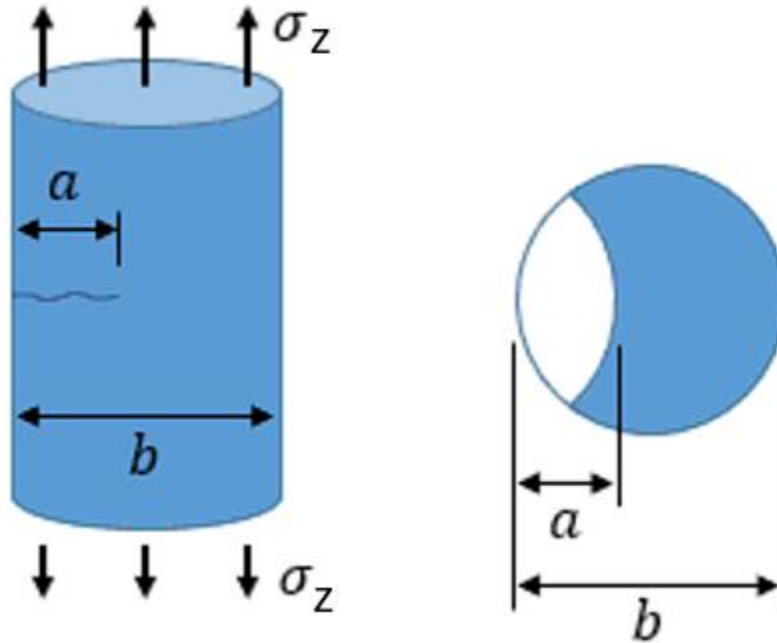
Recall the sign and pole from In-Class Quiz 1, illustrated below with the forces and moments acting at cross-section E labelled. Recall that point C was a critical point on the cross section, with the shear and normal stresses as drawn in the figure below.

Point C on Cross-Section EFIND:

- 1) Assume that the pole is a ductile hot-rolled steel bar with a minimum yield strength in tension and compression of 50 ksi. Determine the factor of safety at point C using:
 - ☐ (25 points) The distortion-energy (DE) theory
 - ☐ (25 points) The maximum-shear-stress (MSS) theory
- 2) Assume that the pole is a (brittle) gray cast iron bar with a minimum ultimate strength in tension of 30 ksi and a minimum ultimate strength in compression of 130 ksi. Determine the factor of safety at point C using:
 - ☐ (25 points) The brittle Coulomb-Mohr (BCM) theory
 - ☐ (25 points) The modified-Mohr (MM) theory

BONUS: (10 points) We found a radial crack in cross section E - at point C, with a depth of approximately 0.005 in. The crack is thumbnail-shaped, and parallel to the xy-plane. Given:

- The fracture toughness of the material is $K_{Ic} = 45.5 \text{ ksi}\sqrt{\text{in}}$,
- The stress intensity modification factor for this geometry is $\beta = 1.1$
- We only need to consider mode I fracture (ignore any shear stress)



Approximate the factor of safety against sudden fracture.