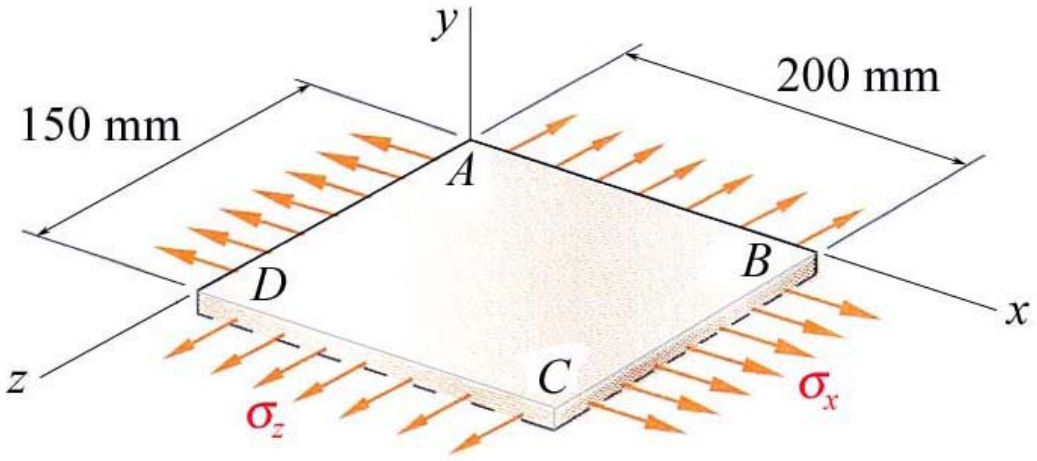
MEEG 3013 Quiz #2.m06.072

A. (3 points) Describe *Saint Venant's principle*.

B. (7 points) A fabric used in air-inflated structures is subjected to a biaxial loading that results in normal stresses σ_x = 120 MPa and σ_z = 160 MPa. If the properties of the fabric can be approximated as E = 87 GPa and ν = 0.34, determine the change in length of (*a*) side *AB*, (*b*) side *BC*, (*c*) diagonal *AC*.



A. *Saint Venant's principle* states that, except in the immediate vicinity of the points of application of the loads, the stress distribution may be assumed independent of the actual mode of application of the loads, which may be axial loads or any other loads. ③

B. $\sigma_x = 120$ MPa, $\sigma_z = 160$ MPa, $E = 87$ GPa, $\nu = 0.34$

$\overline{AB} = 200$ mm, $\overline{BC} = 150$ mm, $\overline{AC} = 250$ mm

$$\varepsilon_x = \frac{\sigma_x}{E} - \nu\frac{\sigma_z}{E} = 0.754023\times10^{-3} \quad \delta_{AB} = \varepsilon_x \overline{AB} \quad \delta_{AB} = 0.1508 \text{ mm}$$

$$\varepsilon_z = \frac{\sigma_z}{E} - \nu\frac{\sigma_x}{E} = 1.370115\times10^{-3} \quad \delta_{BC} = \varepsilon_z \overline{BC} \quad \delta_{BC} = 0.206 \text{ mm}$$ ④

$$\overline{AB}^2 + \overline{BC}^2 = \overline{AC}^2 \qquad 2\overline{AB}\,\delta_{AB} + 2\overline{BC}\,\delta_{BC} = 2\overline{AC}\,\delta_{AC}$$

$$\delta_{AC} = 0.243957 \qquad \delta_{AC} = 0.244 \text{ mm} \quad ③$$