

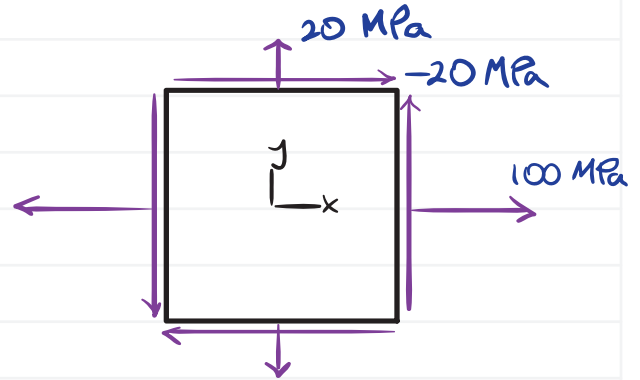
Example: MSS + DE theory for plane stress

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For the element shown, what is the factor of safety  $n$  if the material is ductile hot-rolled steel bar?

$$\sigma_{A,B} = \frac{\sigma_x + \sigma_y}{2} \pm \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$$

$$= 104.7 \text{ MPa}, 15.28 \text{ MPa}$$



$$\sigma_1 = 104.7 \text{ MPa}$$

$$\sigma_2 = 15.28 \text{ MPa}$$

$$\sigma_3 = 0$$

$$\text{MSS: } \sigma_1 - \sigma_3 = \frac{S_y}{n} \Rightarrow n = \frac{S_y}{\sigma_1 - \sigma_3} = \frac{170}{104.7 - 0} = 1.623$$

$$\text{DE: } \sigma' = \left( \frac{(\sigma_1 - \sigma_2)^2 + \sigma_1^2 + \sigma_2^2}{2} \right)^{1/2} = 98.0 \Rightarrow n = \frac{S_y}{\sigma'} = 1.73$$