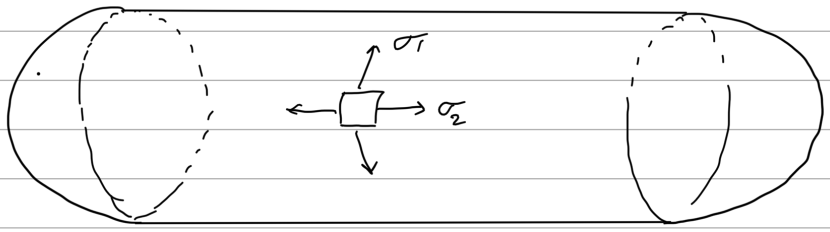
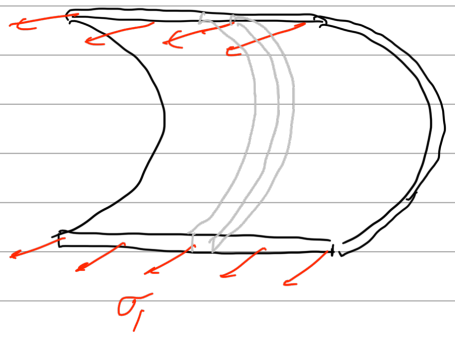
Chapter 8. Combined loadings

8.1. pressure vessel



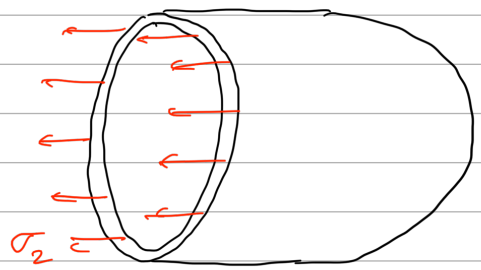
σ_1 : hoop stress

σ_2 : longitudinal stress



$$\sigma_1 \cdot dx \cdot t \cdot 2 = 2r \cdot dx \cdot p$$

$$\therefore \sigma_1 = \frac{pr}{t}$$

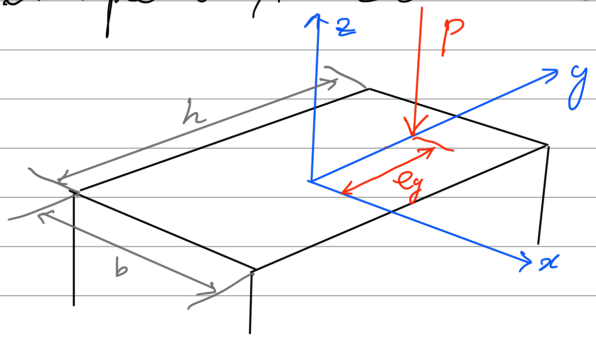


$$\sigma_2 \cdot 2\pi r \cdot t = \pi r^2 \cdot p$$

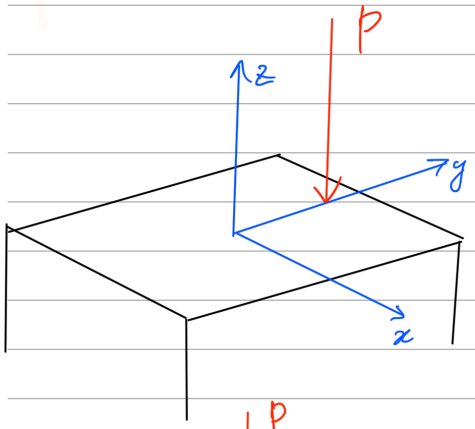
$$\therefore \sigma_2 = \frac{pr}{2t}$$

8.2. State of stress caused by combined loading

Example 8.1. eccentric loading



Range of e_y that does not cause any tensile stress.



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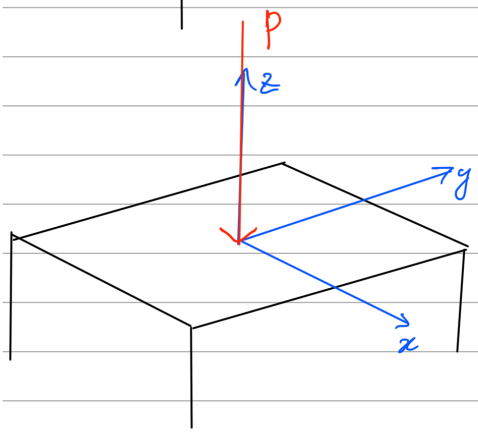

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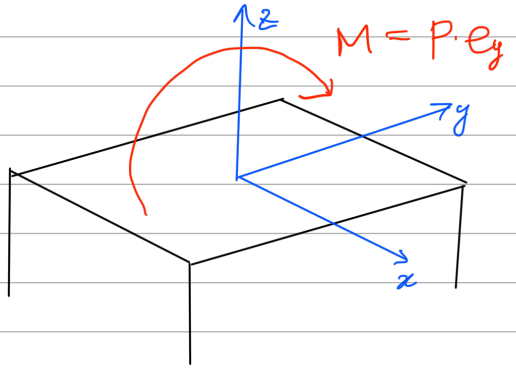


$$\sigma_a = -\frac{P}{bh}$$

$$\sigma_b = -\frac{M}{I}\cdot y$$

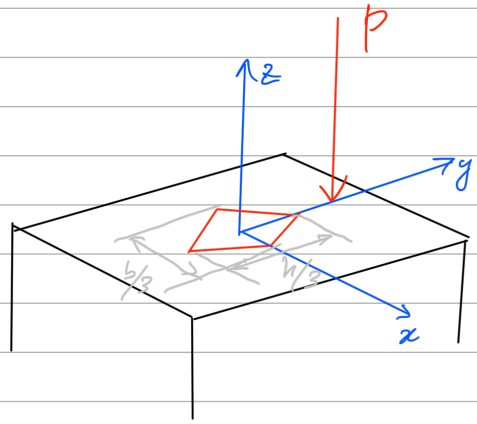
$$\sigma_b\Big|_{y=-\frac{h}{2}} = \frac{Mh}{2I}$$

$$= \frac{P e_y \cdot h}{2\cdot \frac{1}{12} b h^3}$$

$$\therefore \sigma = \sigma_a + \sigma_b\Big|_{y=-\frac{h}{2}}$$

$$= -\frac{P}{bh} + \frac{6P e_y}{bh^2} < 0$$

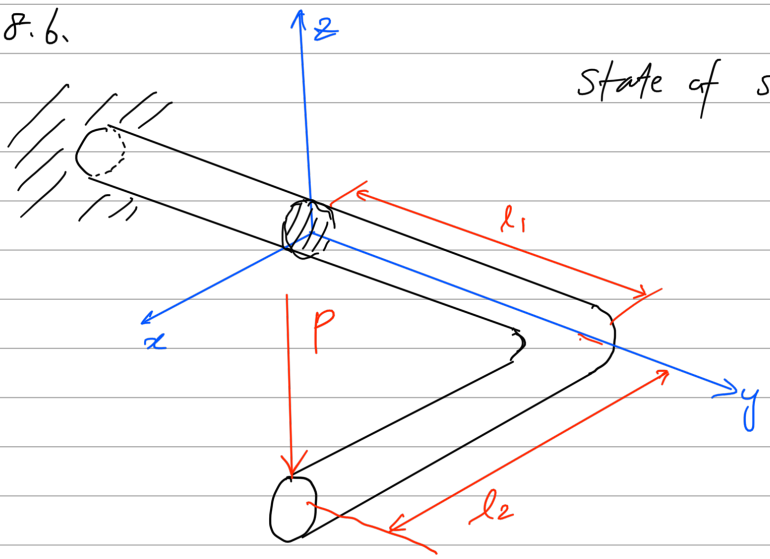
$$\therefore e_y < \frac{P}{bh}\cdot\frac{bh^2}{6P} = \frac{h}{6}$$



middle - third rule

Example 8.6.

State of stress at the origin



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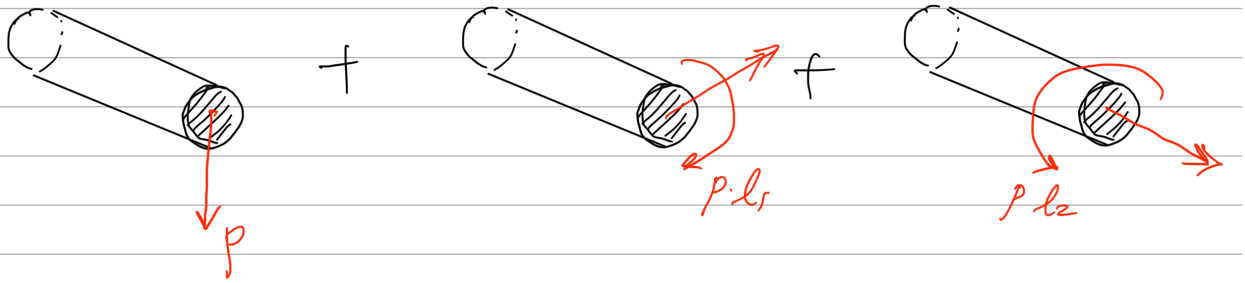

$$\tau = \frac{P \cdot Q}{I \cdot t} \qquad \sigma = + \frac{M_x}{I_x} \cdot z \qquad \tau = \frac{T}{J} \cdot r$$