(*) Tensões longitudinais $\sigma_x = \frac{pR_i}{2e} = \sigma_\theta/2$

Tensões transversais $\sigma_\theta = \frac{pR_i}{2}$

Tensões principais

(I) Na face interna → $\begin{cases} \sigma_1 = \sigma_\theta \\ \sigma_2 = \sigma_x \\ \sigma_3 = -p \end{cases}$

(II) Na face externa ⇒ $\begin{cases} \sigma_1 = \sigma_\theta \\ \sigma_2 = \sigma_x \\ \sigma_3 = 0 \end{cases}$

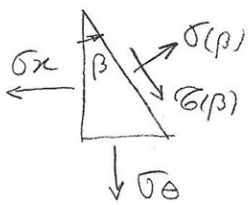
(*) Item (2) $\tau_{máx} = \frac{\sigma_1 - \sigma_3}{2}$

⇒ Na face interna $\tau_{máx} = \frac{\sigma_\theta + p}{2}$

Na face externa $\tau_{máx} = \sigma_\theta/2$

(*) Item (1)

$$\begin{cases} \sigma(\beta) = \frac{\sigma_x+\sigma_\theta}{2} + \frac{\sigma_x-\sigma_\theta}{2}\cos 2\beta + \tau_{xy}\operatorname{sen} 2\beta \\ \tau(\beta) = -\frac{\sigma_x-\sigma_\theta}{2}\operatorname{sen} 2\beta + \tau_{xy}\cos 2\beta \end{cases}$$



$\boxed{\beta = -25°}$

Fazendo $R_i = \phi/2 = \frac{920}{2} = 460\ mm$

$p = 1{,}4\ N/mm^2$, $e = 8\ mm$ →

$$\sigma_\theta = \frac{1{,}4 \times 460}{8} = 80{,}5\ N/mm^2$$

$$\sigma_x = \frac{\sigma_\theta}{2} = 40{,}25\ N/mm^2$$

(*) Item (1)

$$\sigma(\beta) = \frac{40{,}25 + 80{,}5}{2} + \frac{40{,}25 - 80{,}5}{2}\cdot\cos(-50°)$$

$$\sigma(\beta) = 60{,}375 - 20{,}125 \cdot 0{,}643 = 60{,}375 - 12{,}936$$

$\boxed{\sigma(\beta) = 47{,}439\ N/mm^2}$

$$\tau(\beta) = -\frac{40{,}25 - 80{,}5}{2}\cdot\operatorname{sen}(-50°) = 20{,}125 \times (-0{,}766)$$

$\boxed{\tau(\beta) = -15{,}417\ N/mm^2}$

(*) Item (2)

(I) Face interna $\tau_{máx} = \frac{\sigma_\theta + p}{2} = \frac{80{,}5 + 1{,}4}{2} = 40{,}95\ N/mm^2$

(II) Face externa $\tau_{máx} = \frac{\sigma_\theta}{2} = \frac{80{,}5}{2} = 40{,}25\ N/mm^2$ //