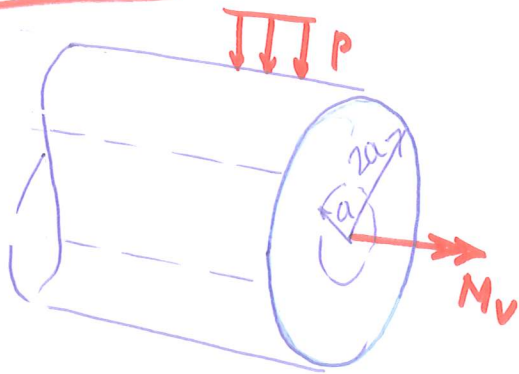


2.9.11



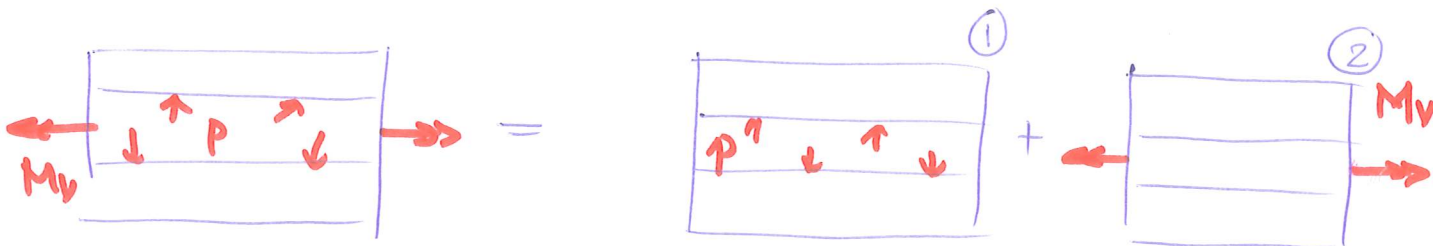
GIVET:

Tjockväggigt rör med
yttre övertryck samt
vridande moment.

SÖKT:

- Spänningstillståndet på inre och
yttre radier.

LÖSNING:

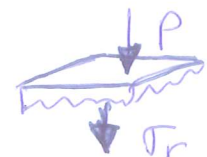


① Spänningar p.g.a. yttre övertryck:

$$[F.S. 7.27] \quad \begin{cases} \sigma_r^{(1)} = A - \frac{B}{r^2} & (1) \\ \sigma_r^{(2)} = A + \frac{B}{r^2} & (2) \\ \sigma_z^{(1)} = 0 & (3) \end{cases}$$

Randvillkor:

$r = a \Rightarrow$ snitta  $\Rightarrow \sigma_r(r=a) = 0 \quad (4)$

$r = 2a \Rightarrow$ snitta  $\Rightarrow \sigma_r(r=2a) = -p \quad (5)$

LÖSA (4) (5) i (1) (2):

$$A = -\frac{4}{3}p; \quad B = -\frac{4}{3}pa^2$$

$$\left\{ \begin{array}{l} \sigma_r^{(1)} = -\frac{4}{3}p \left(1 - \frac{a^2}{r^2}\right) \end{array} \right. \quad (6)$$

$$\left\{ \begin{array}{l} \sigma_\varphi^{(1)} = -\frac{4}{3}p \left(1 + \frac{a^2}{r^2}\right) \end{array} \right. \quad (7)$$

$$\left\{ \begin{array}{l} \sigma_z^{(1)} = 0 \end{array} \right. \quad (8)$$

② Spänningar p.g.a böjmoment:

$$\tau_{z\varphi}^{(2)} = \frac{M_v}{K} r = \left\{ K = \frac{\pi}{2} (b^4 - a^4) = \frac{15\pi a^4}{2} \right\}$$

$$\tau_{z\varphi}^{(2)} = \frac{2M_v r}{15\pi a^4} \quad (9) \quad \sigma_r^{(2)} = \sigma_\varphi^{(2)} = \sigma_z^{(2)} = 0$$

① + ②:

$$\left\{ \begin{array}{l} \sigma_r = -\frac{4}{3}p \left(1 - \frac{a^2}{r^2}\right) \end{array} \right. \quad (10)$$

$$\left\{ \begin{array}{l} \sigma_\varphi = -\frac{4}{3}p \left(1 + \frac{a^2}{r^2}\right) \end{array} \right. \quad (11)$$

$$\left\{ \begin{array}{l} \tau_{z\varphi} = \frac{2M_v r}{15\pi a^4} \end{array} \right. \quad (12)$$

Spänningen på innerradien ($r=a$):

$$\left\{ \begin{array}{l} \sigma_r(r=a) = -\frac{4}{3}p \left(1 - \frac{a^2}{a^2}\right) = 0 \\ \sigma_\varphi(r=a) = -\frac{4}{3}p \left(1 + \frac{a^2}{a^2}\right) = -\frac{8}{3}p \\ \tau_{z\varphi}(r=a) = \frac{2M_v}{15\pi a^4} a = \frac{2M_v}{15\pi a^3} \end{array} \right.$$

Spanningen på yttre radie ($r=b=2a$):

$$\begin{cases} \sigma_r(r=2a) = -\frac{4}{3}p \left(1 - \frac{a^2}{4a^2}\right) = -p \\ \sigma_\varphi(r=2a) = -\frac{4}{3}p \left(1 + \frac{a^2}{4a^2}\right) = -\frac{5}{3}p \\ \tau_{z\varphi}(r=2a) = \frac{4M_v}{15\pi a^3} \end{cases}$$