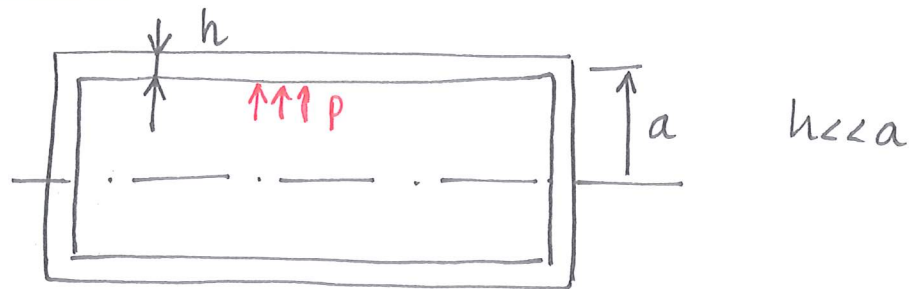


2.8.3

GIVET:



tunnv. rör utsatt för inre övertryck,  $p$ .

Elast. modul:  $E$

Tvärkontraktionskoefficient:  $\nu$

ÖKT: A) Axiella och radiella töjningar.  
B) Diameterökningen hos röret.

LÖSNING:

Pga övertrycket  $\rightarrow \sigma_r, \sigma_\varphi, \sigma_z$   $\tau_{rz} = \tau_{\varphi z} = \tau_{z\varphi} = 0$

Töjningarna ges av Hookes gen. lag:

[F.S.3.1]  $x=r$   $y=\varphi$   $z=z$

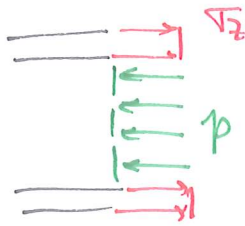
$$\epsilon_r = \frac{1}{E} [\sigma_r - \nu(\sigma_\varphi + \sigma_z)]$$

$$\epsilon_\varphi = \frac{1}{E} [\sigma_\varphi - \nu(\sigma_z + \sigma_r)]$$

$$\epsilon_z = \frac{1}{E} [\sigma_z - \nu(\sigma_r + \sigma_\varphi)]$$

# ①. - Spänningsanalys:

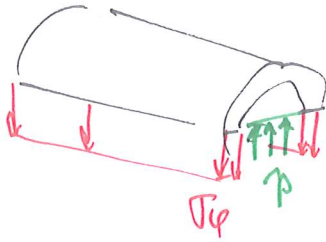
z-nu.)



$$\rightarrow: -p\pi a^2 + \sigma_z \pi 2ah = 0$$

$$\boxed{\sigma_z = \frac{pa}{2h}}$$

y-nu.)



$$\uparrow: p\Delta z 2a - \sigma_\phi h 2\Delta z = 0$$

$$\boxed{\sigma_\phi = \frac{pa}{h}}$$

z-nu.)

$$-p < \sigma_r < 0 \Rightarrow |\sigma_r| \ll \sigma_\phi, \sigma_z \text{ för att } h \ll a$$

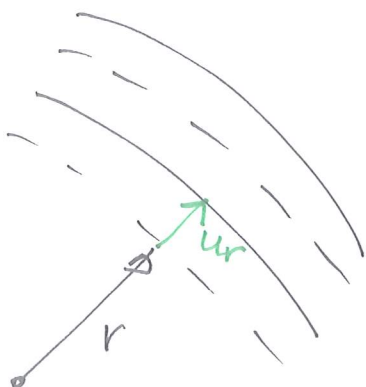
$$\boxed{\sigma_r \approx 0}$$

Töjningar:

$$\text{axiella} \Rightarrow \epsilon_z = \frac{1}{E} \left( \frac{pa}{2h} - \nu \frac{pa}{h} \right) = \frac{pa}{Eh} \left( \frac{1}{2} - \nu \right)$$

$$\text{radiala} \Rightarrow \epsilon_\phi = \frac{1}{E} \left( -\nu \left( \frac{pa}{h} + \frac{pa}{2h} \right) \right) = \frac{pa}{Eh} \left( -\frac{3}{2} \nu \right)$$

B). Diam. ökning:



Töjning i omkretsled

$$\epsilon_\phi = \frac{2\pi(r+u_r) - 2\pi r}{2\pi r} = \frac{u_r}{r}$$

$$\underline{u_r = r\epsilon_\phi} \leftarrow \text{Radialökning}$$

$$\varepsilon_{\varphi} = \frac{1}{E} \left[ \frac{pa}{h} - \nu \frac{pa}{2h} \right] = \frac{pa}{Eh} \left( 1 - \frac{1}{2} \nu \right)$$

$$u_r = a \varepsilon_{\varphi} = \frac{pa^2}{Eh} \left( 1 - \frac{1}{2} \nu \right)$$

Diameter ökning  $\Delta d = \underbrace{2(r + u_r)}_{\text{Diam. efter def.}} - \underbrace{2r}_{\text{Diam innan def.}} = 2u_r$

$$\Delta d = 2u_r = \frac{2pa^2}{Eh} \left( 1 - \frac{1}{2} \nu \right)$$