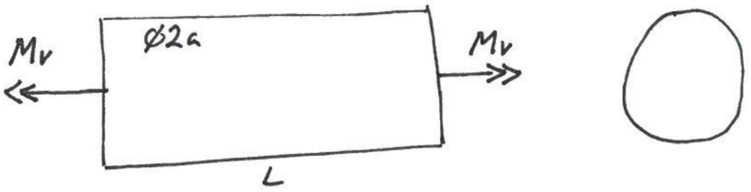
2.6.31 Cylindrisk stång

× Elastiskt-idealpl. mtrl $G \quad \tau_s$

× $M_v = 1.20 \cdot M_s$



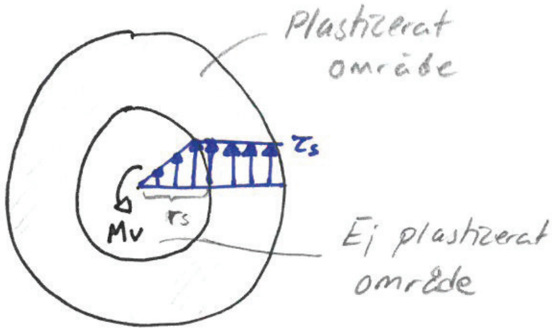
Sökt

a) Bestäm plasticeringsdjupet

b) Bestäm återfjädring och kvarstående deformation vid fullständig avlastning

c) Bestäm restspänningstillståndet

Lösning



Söker r_s

FS. 6.85 $\left[M_v = 2\pi\tau_s\left(\frac{b^4}{3} - \frac{a^4}{4r_s} - \frac{r_s^3}{12}\right)\right] \Rightarrow 1.2 \cdot M_s = 2\pi\tau_s\left(\frac{a^4}{3} - 0 - \frac{r_s^3}{12}\right)$

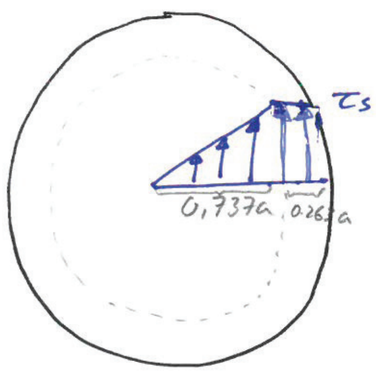
$\Rightarrow$ Lös M_s från FS. 6.86 $\left[M_s = \frac{\pi\tau_s(b^4 - a^4)}{2b}\right]$

Kombinerat fås:

$$1,2 \cdot \frac{\pi\tau_s(a^4 - 0^4)}{2 \cdot a} = 2\pi\tau_s\left(\frac{a^3}{3} - \frac{r_s^3}{12}\right)$$

$\Leftrightarrow$ ... $r_s = 0,737 \cdot a$ dvs plasticeringsdjupet är $(1 - 0,737)a = 0.263\,a$

Svar a)



2.6.31 fortz.

b) Återfjädring

$$\underbrace{M_v = 1.2\,M_s}_{\text{innan}} \xrightarrow{\text{Avlastning}} \underline{\Delta M = -1.2\,M_s}$$

Elastisk avlastning

$$\Delta\theta = \frac{\Delta M \cdot L}{G \cdot K} = \frac{-1.2\,M_s \cdot L}{G \cdot K} \qquad \text{där } K = \frac{\pi a^4}{2}$$

$$\Longrightarrow \Delta\theta = \frac{-2.4 \cdot M_v \cdot L}{\pi G a^4}$$

$$\Longrightarrow \theta_{rest} = \theta_{1.2M_s} + \Delta\theta$$

↑ Från det plastiska fallet

$$\Longrightarrow \theta_{1.2M_s} \cdot r_s = \gamma \cdot L \Longrightarrow \theta_{1.2M_s} = \frac{\tau_s \cdot L}{G \cdot r_s}$$

$$M_s = \frac{\pi \tau_s a^4}{2a}$$

$$\Longrightarrow \theta_{rest} = \frac{\tau_s \cdot L}{G \cdot r_s} + \frac{-2.4\,M_v L}{\pi G a^4} = \ldots = \underline{\underline{0{,}157 \cdot \frac{\tau_s \cdot L}{G \cdot a}}}$$

2.6.31

c) Restspänning

I) Pålastning

$$\tau(r)^{I} = \begin{cases} \tau_s \cdot \frac{r}{r_s} & 0 \leq r \leq r_s \\ \tau_s & r_s \leq r \leq a \end{cases}$$

II) Avlastning

$$\tau(r)^{II} = \ldots = \frac{M \cdot r}{K} = \frac{(-1.2 M_s) \cdot r}{\frac{\pi a^4}{2}} = \left\{ M_s = \frac{\pi a^3}{2} \cdot \tau_s \right\}$$

$$= -1.2 \tau_s \frac{r}{a}$$

III) Restspänning

$$\tau^{III}(r) = \begin{cases} \tau_s r \left(\frac{1}{r_s} - \frac{1.2}{a} \right) & 0 \leq r \leq r_s \\ \tau_s \left(1 - \frac{1.2 r}{a} \right) & r_s \leq r \leq a \end{cases}$$