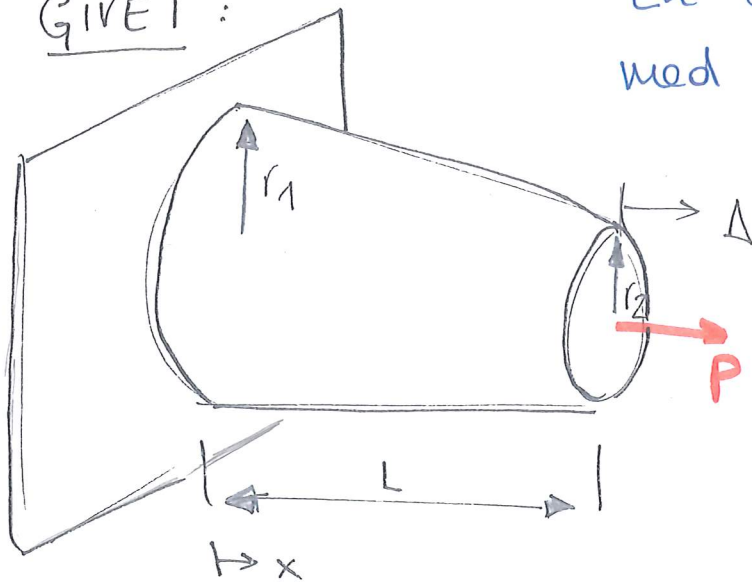


2.1.16

GIVET:



- En svagt konisk stav
med cirkulärt tvärsnitt

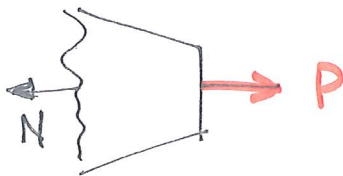
- Linjärt elastiskt
material

- Elasticitetsmodulen: E

SÖKT: kraft-deformation sambandet

LÖSNING:

①. Normalkrafter: m.h.a jmv.



$$\rightarrow : +P - N = 0$$

$$\underline{N = P} \quad (1)$$

② Normalspänningar: m.h.a def på spänning

$$\sigma(x) A(x) = P; \quad \sigma(x) = \frac{P}{A(x)} \quad (2)$$

Area? $A(x) = \pi r(x)^2 \Leftarrow$ cirkulärt tvärsnitt (3)

Kone \Rightarrow arean $r(x) = C_1 + C_2 x$ (4)

$$r(0) = C_1 = r_1 \quad \dots \quad (5)$$

$$r(L) = C_1 + C_2 L = r_2 \Rightarrow \frac{r_2 - r_1}{L} = C_2 \quad (6)$$

sätt in (5) och (6) i (4):

$$r(x) = r_1 + \frac{(r_2 - r_1)}{L} x \quad (7)$$

sätt in (7) i (3), 2:

$$\sigma(x) = \frac{P}{\pi \left(r_1 + \frac{(r_2 - r_1)}{L} x \right)^2} \left[\frac{N}{m^2} \right] \quad (8)$$

(3) Töjningar (m.h.a. konstitutiva ekv)

$$\sigma(x) = E \epsilon(x) \quad \epsilon(x) = \frac{P}{E \pi \left(r_1 + \frac{(r_2 - r_1)}{L} x \right)^2} \left[\frac{N}{m^2 \cdot m^2} \right] \quad (9)$$

(4) Deformation (m.h.a. def på töjning)

$$d\delta = \epsilon dx \quad \rightarrow \text{Int: } \Delta = \int_0^L d\delta = \int_0^L \epsilon(x) dx$$

↑
töjningen är
inte konstant

$$\Delta = \frac{P}{E \pi} \int_0^L \frac{1}{r^2(x)} dx = \frac{P}{E \pi} \int_0^L \frac{1}{(ax+b)^2} dx = \left\{ \begin{array}{l} \text{Beta s149} \\ \text{ekv 6} \end{array} \right\}$$

$$\Delta = \frac{P}{E \pi} \left[\frac{-1}{a(ax+b)} \right]_0^L = \dots = \frac{PL}{E \pi r_1 r_2} \left[\frac{Nm}{\cancel{Kl} / m^2 m^2} \right] = [m]$$

$$\begin{aligned} & \frac{P}{E \pi} \frac{-1}{\frac{(r_2 - r_1)}{L} \left(\frac{(r_2 - r_1)L}{L} + r_1 \right)} - \frac{-P}{E \pi \frac{(r_2 - r_1)}{L} r_1} = \frac{-PL}{E \pi (r_2 - r_1) r_2} + \frac{PL}{E \pi (r_2 - r_1) r_1} \\ & = \frac{(-r_1 + r_2) PL}{E \pi (r_2 - r_1) r_2 r_1} \end{aligned}$$