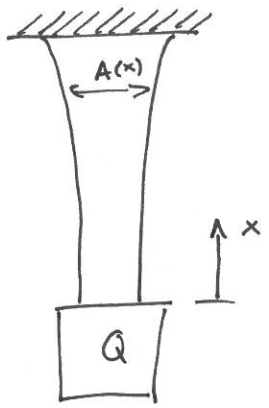
2.1.9 Grundlina med varierande area

Givet



× Tvärsnitt $A(x)$
× Tyngd Q + egenvikt
× Tillåten spänning σ_{till}

Sökt $A(x)$ så att $\sigma(x) = \sigma_{till}$ (konstant) "Metod 2"

Lösning

(FS. 6.3)

$$\left[\frac{dN(x)}{dx} + K_x(x)\, A(x) = 0 \right]$$

där...

$$N(x) = \sigma(x) \cdot A(x) \longrightarrow \sigma(x) = \sigma_{till} \rightarrow N(x) = \sigma_{till} \cdot A(x)$$

$$K_x(x) = \left[\frac{\text{kraft}}{\text{volym}} \right] = \frac{-m \cdot g}{V} = -\rho g$$

$$\Leftrightarrow \frac{d}{dx}\left(\sigma_{till} \cdot A(x)\right) + -\rho g \cdot A(x) = 0 \Leftrightarrow \frac{dA}{dx} = \frac{\rho g}{\sigma_{till}} \cdot A(x) \longrightarrow \text{Dif. ekv!}$$

$$\Rightarrow A(x) = C \cdot \exp\left(\frac{\rho g}{\sigma_{till}} \cdot x\right)$$

R.V. $\sigma(x=0) = \frac{N(x=0)}{A(x=0)} = \frac{Q}{A(0)} = \sigma_{till} \Leftrightarrow A(0) = \frac{Q}{\sigma_{till}}$

$$\therefore A(x) = \frac{Q}{\sigma_{till}} \cdot \exp\left(\frac{\rho g}{\sigma_{till}} \cdot x\right)$$