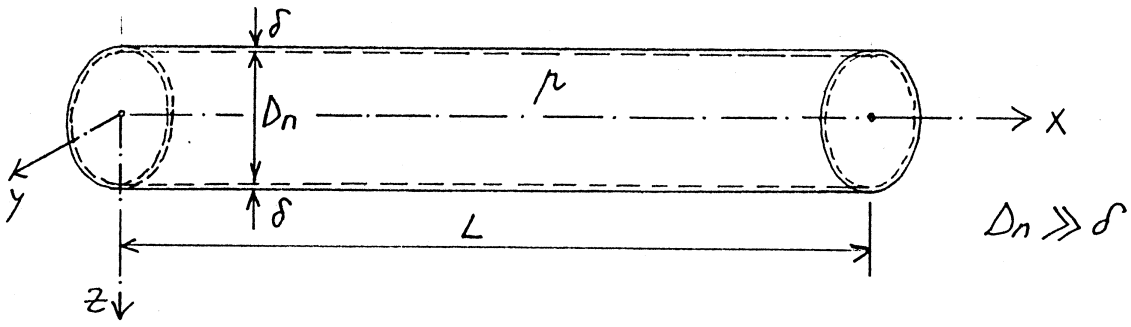
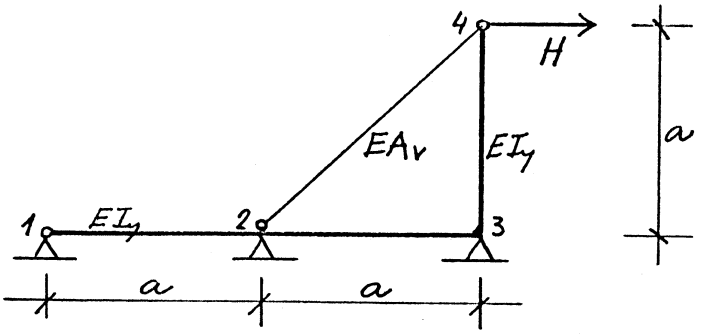
MTT IZPIT 17.12.1992

1. Pojasni, zakaj hrenovka vedno poči podolgem! (Obravnavaj poenostavljen primer valjaste tankostenske posode z enakomernim notranjim pritiskom.)

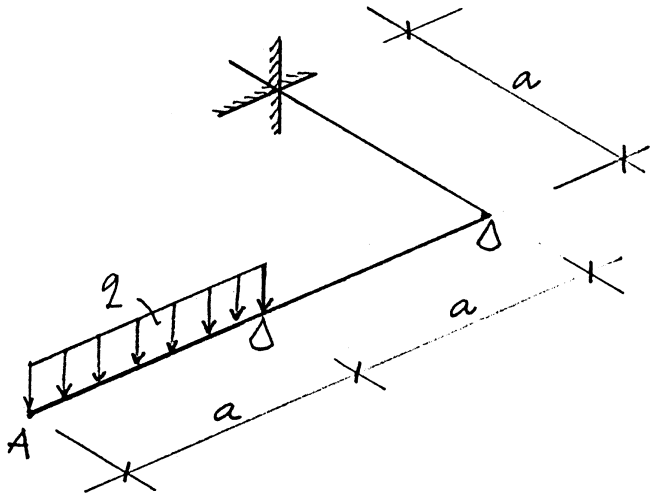


2. Dopustna napetost vrvi $\overline{24}$ je $[\sigma]$. Določi potrebni prerez vrvi A_v v odvisnosti od obtežbe H! Pri tem lahko zanemariš osno podajnost stebra $\overline{34}$. Določi in skiciraj tudi notranje sile!



3. Določi poves točke A!

$EI_y = GI_x$



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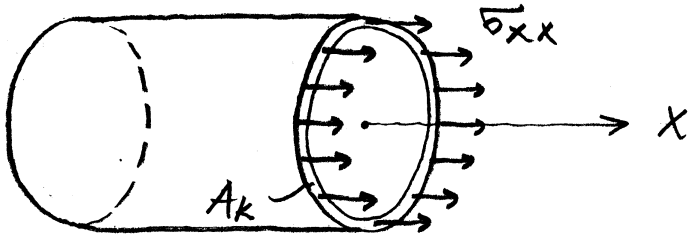
Ad 1.)



$$\Sigma X = 0 \rightarrow \sigma_{xx} \cdot A_k - p \cdot \frac{\pi D_n^2}{4} = 0$$

$$A_k = \frac{\pi}{4}\left[(D_n + 2\delta)^2 - D_n^2\right] = \frac{\pi}{4}\left(D_n^2 + 4D_n\delta + 4\delta^2 - D_n^2\right)$$

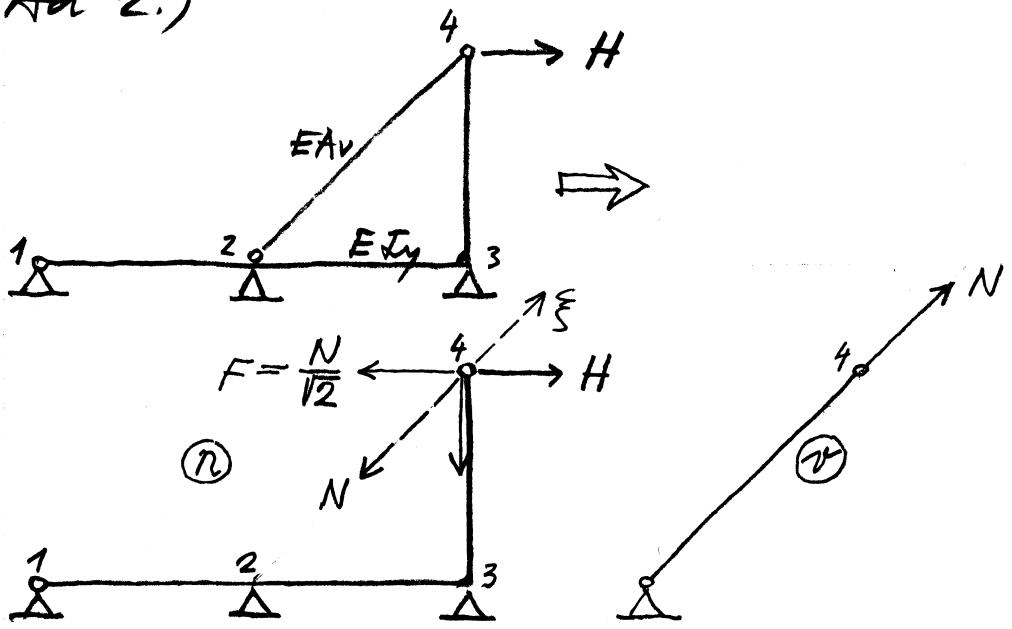
$$A_k = \pi\delta(D_n + \delta) \cong \pi\delta D_n \qquad (\delta \ll D_n)$$

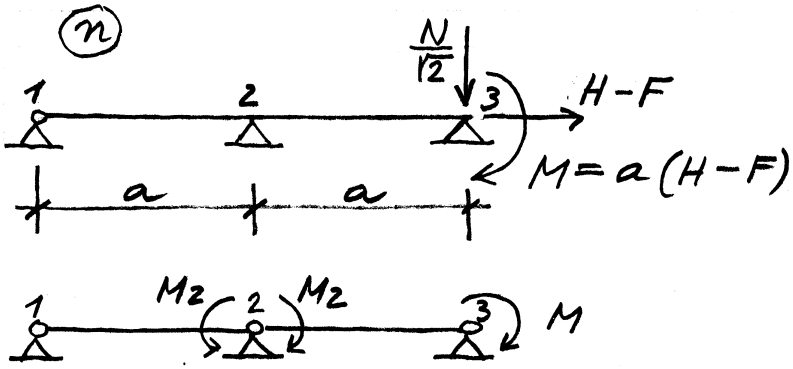
$$\sigma_{xx} \cdot \pi\delta D_n = p\frac{\pi}{4}D_n^2 \rightarrow \boxed{\sigma_{xx} = \frac{pD_n}{4\delta}}$$

Iz hotelne formule: $\boxed{\sigma_{ss} = \frac{pD_n}{2\delta}}$

$\boxed{\sigma_{ss} = 2\sigma_{xx}}$ → zato hrenorha poči podolgem.

Ad 2.)





$$\omega_2^L = M_2 \frac{a}{3EI_y}\,; \qquad \omega_2^D = M\frac{a}{6EI_y} - M_2\frac{a}{3EI_y}$$

$$\boxed{\omega_2^L = \omega_2^D} \longrightarrow \boxed{M_2 = \frac{M}{4} = \frac{a}{4}(H-F)}$$

$$\omega_3 = M_2\frac{a}{6EI_y} - M\frac{a}{3EI_y} \longrightarrow \boxed{\omega_3 = -(H-F)\frac{7a}{24EI_y}}$$

$$u_x^{(n)}(4) = -\omega_3 a + (H-F)\frac{a^3}{3EI_y}$$

$$\boxed{u_x^{(n)}(4) = (H-F)\frac{5a^3}{8EI_y}} \qquad \boxed{u_z^{(n)}(4) = 0}$$

$$u_\xi^{(v)}(4) = N\frac{a\sqrt{2}}{EA_v} \longrightarrow \boxed{u_\xi^{(v)}(4) = F\frac{2a}{EA_v}}$$

v bodě 4: $u_\xi^{(w)} = u_x^{(u)} e_{\xi x} + u_z^{(n)} e_{\xi z}$

$$\boxed{u_\xi^{(w)} = u_x^{(u)} \cdot \frac{\sqrt{2}}{2}}$$

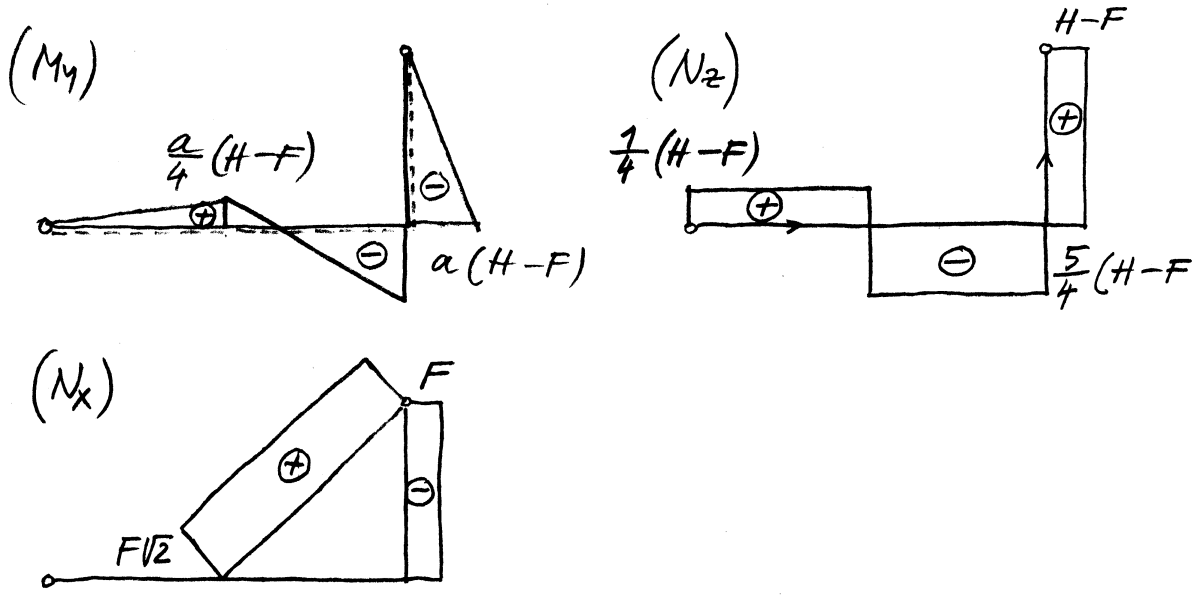
$$F\cdot\frac{2a}{EA_v} = (H-F)\frac{5\sqrt{2}\,a^3}{16EI_y}$$

$$F\left(\frac{2}{A_v} + \frac{5\sqrt{2}\,a^2}{16I_y}\right) = H\frac{5\sqrt{2}\,a^2}{16I_y}$$

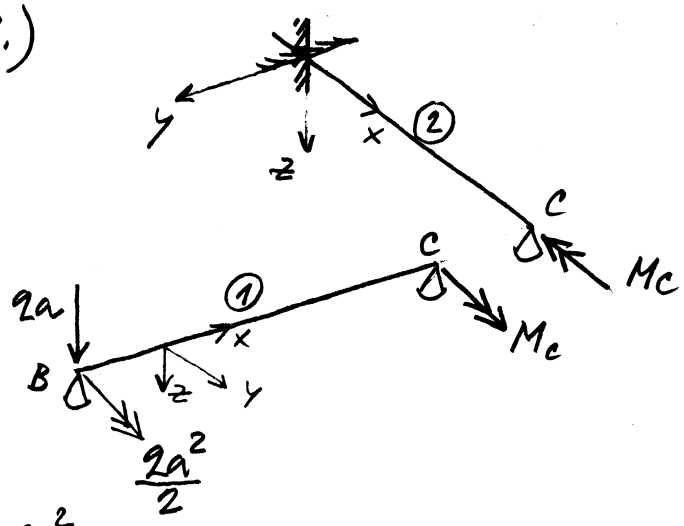
$$F = \frac{N}{\sqrt{2}} \longrightarrow N\left(\frac{\sqrt{2}}{A_v} + \frac{5a^2}{16I_y}\right) = H\frac{5\sqrt{2}\,a^2}{16I_y}$$

$$[N] = A_v[\sigma] \longrightarrow \sqrt{2}[\sigma] + A_v[\sigma]\frac{5a^2}{16I_y} = H\frac{5\sqrt{2}\,a^2}{16I_y}$$

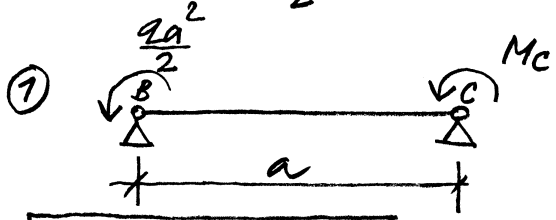
$$\boxed{A_v = H\frac{\sqrt{2}}{[6]} - \frac{16\sqrt{2}\,I_y}{5a^2}}$$



Ad 3.)



$$\omega_x^{②}(C) = -M_c\frac{a}{GI_x}$$



$$\omega_y^{①}(C) = \frac{a}{6EI_y}\left(2M_c - \frac{qa^2}{2}\right)$$

$$\boxed{\omega_x^{②}(C) = \omega_y^{①}(C)} \longrightarrow -M_c\frac{a}{GI_x} = M_c\frac{a}{3EI_y} - \frac{qa^3}{12EI_y}$$

$$EI_y = GI_x \longrightarrow M_c\left(\frac{1}{3}+1\right) = \frac{qa^2}{12}$$

$$\boxed{M_c = \frac{qa^2}{16}}$$

$$w_y(B) = \frac{a}{6EI_y}\left(2\cdot\frac{qa^2}{2} - M_c\right) = \frac{qa^3}{6EI_y} - \frac{qa^3}{96EI_y}$$

$$\boxed{w_y(B) = \frac{5qa^3}{32EI_y}}$$

$$w_A = a\cdot w_y(B) + \frac{qa^4}{8EI_y}$$

$$\boxed{w_A = \frac{9qa^4}{32EI_y}}$$