

2) Izračunajte največjo Huber-jevo primerjalno napetost v nosilec AB. Vpliv notranjih osnih in strižnih sil zanemarite.

$$M_{up} = \sqrt{M_y^2 + M_z^2} = \sqrt{100^2 + (-300)^2}$$

$$M_{up} = 316,23 \text{ Nm}$$

$$\sigma_{upk} = -\frac{M_{up}}{J} \cdot z_k$$

$$\sigma_{upk} = -\frac{316,23 \cdot 1000}{75625,25} \cdot \frac{45}{2}$$

$$\sigma_{upk} = -94,016 \text{ MPa}$$

$$J_1 = J_2 = J = \frac{\pi(45^4 - 40^4)}{64}$$

$$J = 75625,25 \text{ mm}^4$$

$$W_{min} = 3361,12 \text{ mm}^3$$

$$I. \text{ polje}$$

$$J_T = J_p = \frac{\pi(45^4 - 40^4)}{32}$$

$$J_T = 151250,51 \text{ mm}^4$$

$$W_{Tmin} = 6722,24 \text{ mm}^3$$

$$\tau = \frac{150 \cdot 1000}{6722,24} = 22,31 \text{ MPa}$$

$$F_1 = 300 \text{ N}$$

$$F_2 = 100 \text{ N}$$

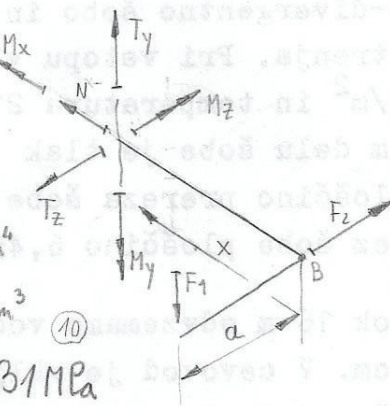
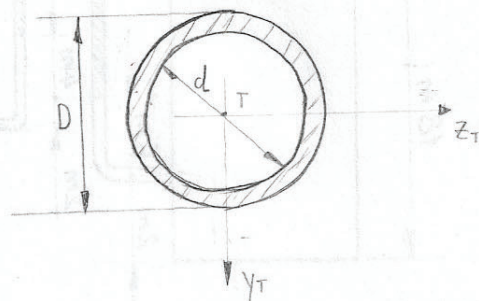
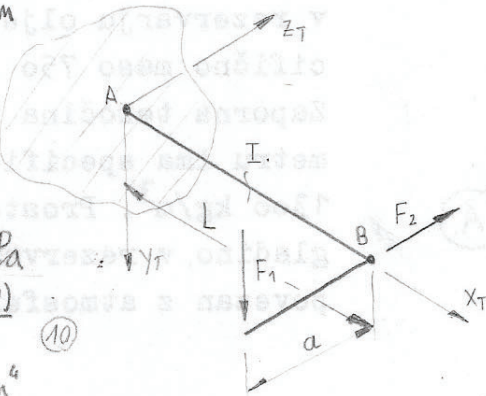
$$L = 1000 \text{ mm}$$

$$a = 500 \text{ mm}$$

$$D = 45 \text{ mm}$$

$$d = 40 \text{ mm}$$

$$\sigma_{pmax} = ?$$



$$M_x - F_1 \cdot a = 0$$

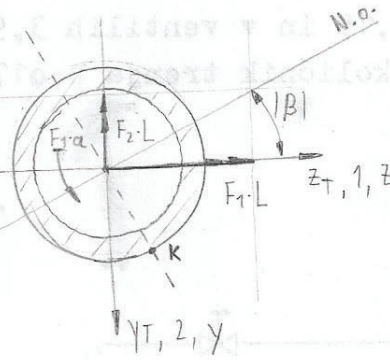
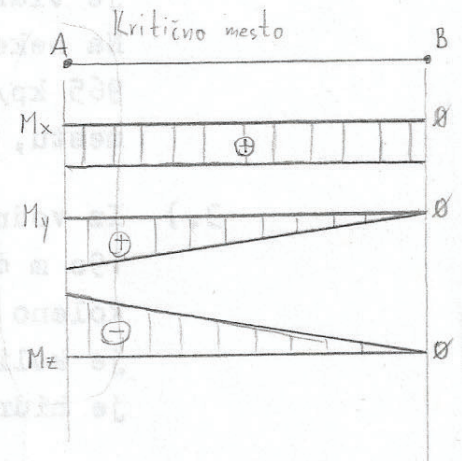
$$M_y - F_2 \cdot x = 0$$

$$M_z + F_1 \cdot x = 0$$

$$M_x = F_1 \cdot a$$

$$M_y = F_2 \cdot x$$

$$M_z = -F_1 \cdot x$$



$$M_{xA} = F_1 \cdot a = 150 \text{ Nm}$$

$$M_{yA} = F_2 \cdot L = 100 \text{ Nm}$$

$$M_{zA} = -F_1 \cdot L = -300 \text{ Nm}$$

$$\text{Upogib: } \sigma = \frac{M_1}{I_1} \cdot y - \frac{M_2}{I_2} \cdot z$$

$$M_1 = M_{zA} = -300 \text{ Nm}$$

$$M_2 = M_{yA} = 100 \text{ Nm}$$

$$I_1 = I_2 = I = \frac{\pi \cdot (D^4 - d^4)}{64}$$

Položaj nevtralne osi:

$$\tan \beta = \frac{I_1}{I_2} \cdot \frac{M_2}{M_1} = 1 \cdot \frac{F_2 \cdot L}{-F_1 \cdot L} = -\frac{F_2}{F_1} \Rightarrow \beta = -18,435^\circ$$

$$y_k = \frac{D}{2} \cdot \cos(18,435^\circ) = 21,345 \text{ mm}$$

$$z_k = \frac{D}{2} \cdot \sin(18,435^\circ) = 7,115 \text{ mm}$$

$$\text{Torzija: } \tilde{\sigma}_{nax} = \frac{M_{xA}}{W_T} = \frac{M_{xA}}{I_T / D/2}$$

$$\tilde{\sigma}_{nax} = \frac{F_1 \cdot a}{\frac{\pi(D^4 - d^4)}{32} \cdot \frac{D}{2}} = \frac{16 \cdot F_1 \cdot a \cdot D}{\pi(D^4 - d^4)}$$

$$\tilde{\sigma}_{nax} = \frac{16 \cdot 300 \text{ N} \cdot 500 \text{ mm} \cdot 45 \text{ mm}}{\pi(45^4 - 40^4)} = 22,314 \text{ MPa} = \tilde{\sigma}_k$$

$$\sigma_k = \frac{M_1}{I_1} \cdot y_k - \frac{M_2}{I_2} \cdot z_k = \frac{-300 \cdot 10^3 \text{ Nm} \cdot 64}{\pi \cdot (45^4 - 40^4)} \cdot 21,345 \text{ mm}$$

$$- \frac{100 \cdot 10^3 \text{ Nm} \cdot 64}{\pi \cdot (45^4 - 40^4)} \cdot 7,115 \text{ mm} = -94,082 \text{ MPa}$$

$$\sigma_{pk} = \sigma_{pmax} = \sqrt{\sigma_k^2 + 3\tilde{\sigma}_k^2} = \sqrt{(-94,082 \text{ MPa})^2 + 3 \cdot (22,314 \text{ MPa})^2} = -94,082 \text{ MPa}$$

$$= \boxed{107,71 \text{ MPa}}$$

$$(\sigma_k = -\frac{L \cdot D/2 \cdot \sqrt{F_1^2 + F_2^2}}{I} = -94,084 \text{ MPa})$$

Zaokroževanje.