

# Vaje

Tilen Pintarič

20. december 2022

Nadaljujemo z izračunom zobnika od prejšnje vaje

Krogi za prvi zobnik ( $n = 15$ )

$$d_1 = \frac{3 * 15}{\cos 15 \text{ deg}}$$

$$d_1 = 46.58743mm$$

$$d_b = 46.58743 * \cos 20.65 \text{ deg}$$

$$d_b = 43.59428$$

$$d_w = 46.58743 * \frac{\cos 20.65 \text{ deg}}{\cos 21.94577}$$

$$d_w = 47.00000$$

---

Ponoven

izračun

pro-

fil-

nih

pre-

mikov

$$\beta_b = \arcsin \sin 15 \text{ deg} * \cos 20 \text{ deg}$$

$$\beta_b = 14.07609$$

$$z_{n1} = \frac{15}{\cos^2 14.07809 * \cos 15 \text{ deg}} z_{n1} = 16.50546$$

$$z_{n2} = \frac{45}{\cos^2 14.07809 * \cos 15 \text{ deg}}$$

$$z_{n2} = 49.5164$$

$$z_{n1} + z_{n2} = \frac{16.50546 + 49.5164}{2} = 33.01093$$

$$\frac{x_1 + x_2}{2} = 0.141755$$

---

Iz  
tabele  
odči-  
tamo  
 $x_1 =$   
0.35;  
 $x_2 =$   
0.2835–  
0.35 =  
–0.06649.

---

Nadaljujemo izračun krogov

$$d_f = 46.58743 - 2 * (1.25 * 0.35 + 3)$$

$$d_f = 41.18743$$

$$d_2 = \frac{3 * 45}{\cos 15 \text{ deg}} = 139.7623$$

$$k = a - a_d - mn(x_1 + x_2)$$

$$k = 94mm - \frac{d_1 + d_2}{2} - m_n(x_1 + x_2)$$

$$k = 94 - \frac{46.58743 + 139.7623}{2} - 3 * (0.28351)$$

$$k = -0.025395$$

$$d_a = 46.58743 + (3 + 0.35 * 3 - 0.025395)$$

$$d_a = 50.61203$$


---

Zaokrožitve

$$\rho_{fp} = \frac{C_p}{1 - \sin \alpha}$$

$$\rho_{fp} = \frac{0.25 * 3}{1 - \sin 20 \text{ deg}}$$

$$\rho_{fp} = 1.1398$$

**Krogi za drugi zobnik (n = 45)**

$$d = \frac{3 * 45}{\cos 15 \text{ deg}}$$

$$d = 139.7623mm$$

$$d_b = 139.7623 * \cos 20.65 \text{ deg}$$

$$d_b = 130.78286$$

$$d_w = 139.7623 * \frac{\cos 20.65 \text{ deg}}{\cos 21.94577}$$

$$d_w = 140.99999$$

$$d_f = 139.7623 - 2 * (1.25 * 0.35 + 0.06649 * 3)$$

$$d_f = 132.66124$$

$$d_a = 139.7623 + (3 - 0.06649 * 3 - 0.025395)$$

$$d_a = 142.53744$$

#### **Izračun profilne stopnje prekrivanja zob**

$$\epsilon_\alpha = \frac{\sqrt{d_{a1}^2 - d_{b1}^2} + \sqrt{d_{a2}^2 - d_{b2}^2} - 2a * \sin \alpha_{wt}}{2m_t \pi \cos \alpha_t}$$

$$\epsilon_\alpha = \frac{\sqrt{50.61241^2 - 43.59428^2} + \sqrt{142.53744^2 - 130.782857^2} - 2 * 94 * \sin 21.94577 \text{ deg}}{2 * \frac{3}{\cos 15 \text{ deg}} \pi \cos 20.65 \text{ deg}}$$

$$\epsilon_\alpha = 0.66444$$

#### **Bočna stopnja prekrivanja**

$$\epsilon_\beta = \frac{b_a * \sin \beta}{m_n * \pi}$$

$$\epsilon_\beta = \frac{0.5 * 46.5874 * \sin 15 \text{ deg}}{3 * \pi}$$

$$\epsilon_\beta = 0.63907$$

#### **Skupna stopnja prekrivanja**

$$\epsilon = \epsilon_\alpha + \epsilon_\beta = 0.66444 + 0.63907$$

$$\epsilon = 1.3041$$

**Za izris zobnikov potrebujemo še širino zob in širino zobne vrzeli**

$s_t$  - ločna dolžina

$$s_t = \frac{P_t}{2} + 2 * x * m_n * \tan \alpha = m_t * \left( \frac{\pi}{2} + 2x * \tan \alpha_n \right)$$

$$e_t = \frac{P_t}{2} - 2 * x * m_n * \tan \alpha = m_t * \left( \frac{\pi}{2} - 2 * x * \tan \alpha_n \right)$$

Drugi  
zob-  
nik -  
x je  
neg-  
a-  
tiven,  
zato  
se  
predz-  
nak  
spre-  
meni  
v  
for-  
muli

$$s_t = \frac{3}{\cos 15 \deg} * \left( \frac{\pi}{2} - 2 * 0.06649 \tan 20 \deg \right)$$

$$s_t = 4.728299mm$$

$$e_t = \frac{3}{\cos 15 \deg} * \left( \frac{\pi}{2} + 2 * 0.06649 * \tan 20 \deg \right) e_t = 5.028998mm$$

## Preračun gredi in ležajev

Za preračun gredi (notranji moment) in ležajev (reakcije) potrebujemo sile na zobnike

Falijo mi zapiski če če mogoče kdu poslat? :D

## Jermenska gonila

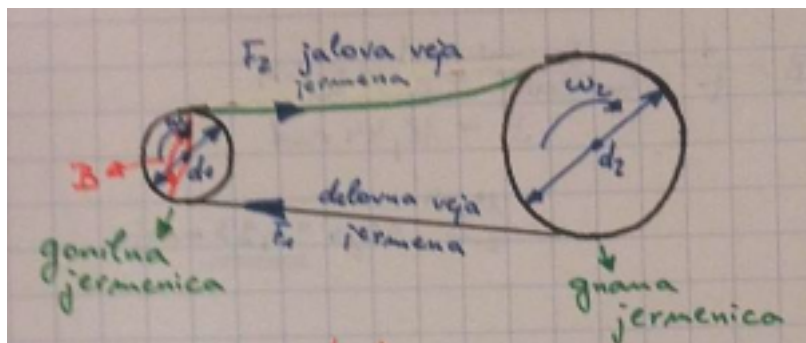


Figure 1: jermenska gonila

$B$  - objemni kot

$F_1$  - sila v delovni veji

$F_2$  - sila v jalovi veji

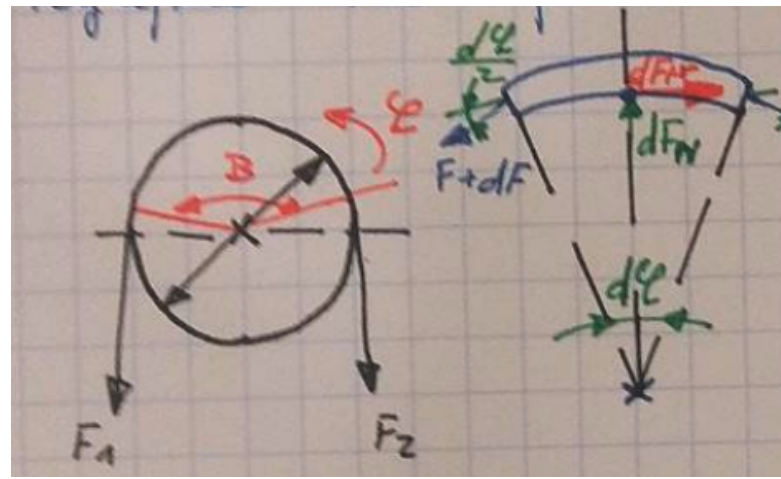
$$i = \frac{d_2}{d_1} = \frac{\omega_1}{\omega_2} = \left(\frac{z_2}{z_1}\right) \quad \text{samo pri zobatih jermenih in jermenica}$$

Moment na jermenici:

$$T = \frac{F_1 - F_2}{\frac{d_a}{2}}$$

Razmerje sil na meji zdrsa:

$$m = \frac{F_1}{F_2} = e^{uB}$$



Poglejmo razmerje sil na meji zdrsa jermena: