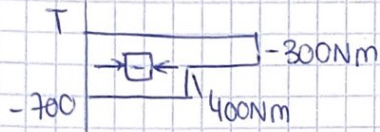
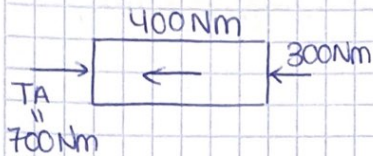


$$G = 77 \text{ GPa}; \tau_{\text{MAX}}? \varphi_B? \varphi_C?$$

Solido askearen diagrama:



$\tau_{\text{MAX}} \rightarrow$ AB zatiari Nm·Nmm

$$\tau_{\text{MAX}}^{AB} = \frac{T \cdot r}{I_p} = \frac{700 \cdot 10^3 \cdot 23}{(\pi \cdot 23^4)/2} = 36,6 \text{ MPa}$$

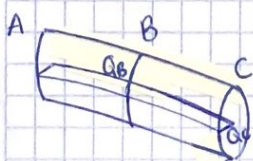
$$\tau_{\text{MAX}}^{BC} = \frac{300 \cdot 10^3 \cdot 15}{(\pi \cdot 15^4)/2} = 56,6 \text{ MPa}$$

Deformazioak:

$$\varphi = \frac{\sum T_i \cdot L_i}{G \cdot I_p}$$

$$\varphi_{AB} = \frac{T_{AB} \cdot L_{AB}}{G \cdot I_p^{AB}} = \frac{700 \cdot 10^3 \cdot 750}{77 \cdot 10^3 \cdot (\pi \cdot 23^4)/2} = -0,0155 \text{ rad} \rightarrow -0,0155 \cdot \frac{180}{\pi} = -0,89^\circ$$

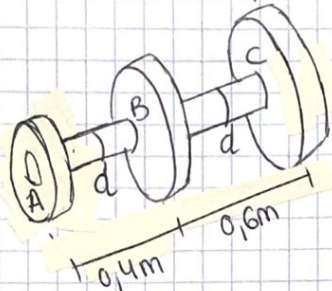
$$\varphi_{BC} = \frac{300 \cdot 10^3 \cdot 900}{77 \cdot 10^3 \cdot (\pi \cdot 15^4)/2} = -0,044 \text{ rad} \rightarrow -0,044 \cdot \frac{180}{\pi} = -2,52^\circ$$



$$\varphi_B = \varphi_{AB} = -0,89^\circ$$

$$\varphi_C = \varphi_B + \varphi_{BC} = -3,41^\circ$$

X Irudiko ardatzak motoraren 4,2kW potentzia B engranajearen jasotzen du. Potentzia A eta B engranajea zabaltzen da 200rpm biraketa abiaduran. Ardatzaren materialaren tentsio ebakitzaila onargamia 65MPa bada eta A-tik C-ra biratzen duen angelua gradu bat baino txikiagoa izan behar badu, kalkulatu ardatzak behar duen (d) diametro minimoa.



$$G = 77 \text{ GPa}; \varphi_{Ac} \leq 1^\circ; \tau_{onarg} = 65 \text{ MPa};$$

$$P_D = P_B = 4,2 \text{ kW}; P_A = 3,1 \text{ kW}; P_C = 1,1 \text{ kW};$$

$$b = 200 \text{ rpm}$$

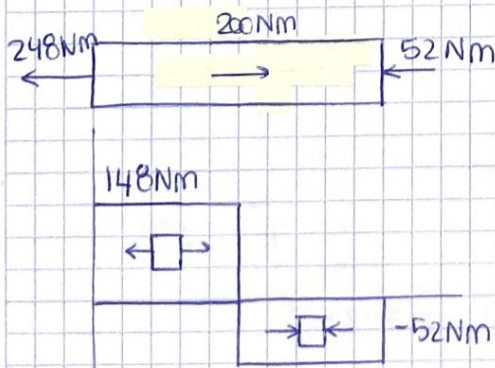
Bihurdura-momentuak:

$$P_B = T_B \cdot \omega \rightarrow 4,2 \cdot 10^3 = T_B \cdot 200 \cdot \frac{2\pi}{60} \rightarrow T_B = 200 \text{ Nm}$$

$$P_A = T_A \cdot \omega \rightarrow 3,1 \cdot 10^3 = T_A \cdot 200 \cdot \frac{2\pi}{60} \rightarrow T_A = 148 \text{ Nm}$$

$$P_C = T_C \cdot \omega \rightarrow 1,1 \cdot 10^3 = T_C \cdot 200 \cdot \frac{2\pi}{60} \rightarrow T_C = 52 \text{ Nm}$$

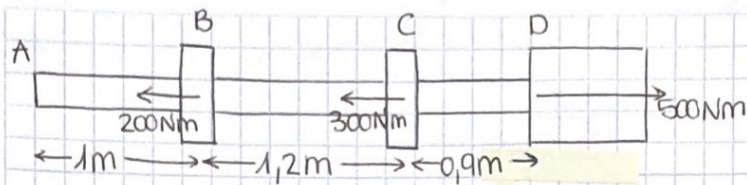
Solido askearen diagrama



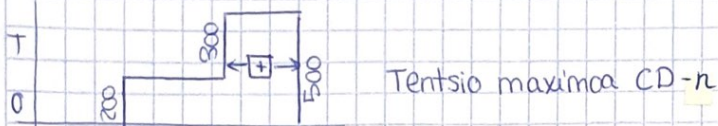
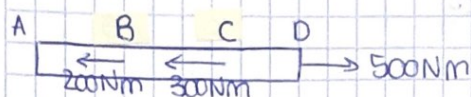
angeluaren bidez

$$1^\circ = \frac{T_{AB} \cdot L_{AB} - T_{BC} \cdot L_{BC}}{77 \cdot 10^3 (\pi r^4) / 2} \rightarrow d = 27 \text{ m}$$

Tentsioaren bidez $\rightarrow \tau = \frac{T \cdot r}{(\pi r^4) / 2} \rightarrow d = 22,8 \text{ m}$



$\omega = 30\pi \text{ rad/s}$
 $f = 15 \text{ Hz}; \Phi_{\text{kamp}} = 50 \text{ mm}; \Phi_{\text{barne}} = 42 \text{ mm}; G = 27 \text{ GPa}$

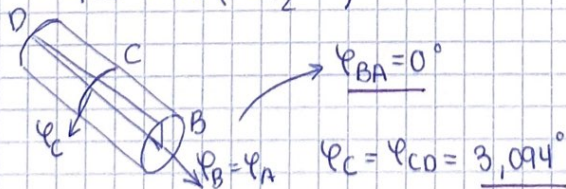


a) $P_D = T_D \cdot \omega = 500 \cdot 30\pi = -15000\pi \text{ kW}$

b) $\tau_{xy}^{CD} = \frac{T \cdot r}{I_p} = \frac{500 \cdot 10^3 \cdot 25}{\frac{\pi(25^4 - 21^4)}{2}} = 40,57 \text{ MPa}$

c) $\varphi_{CD} = \frac{T_{CD} \cdot L_{CD}}{G \cdot I_{pCD}} = \frac{500 \cdot 10^3 \cdot 900}{27 \cdot 10^3 \left(\frac{\pi(25^4 - 21^4)}{2} \right)} = 0,054 \text{ rad} \cdot \frac{180^\circ}{\pi \text{ rad}} = 3,094^\circ$

$\varphi_{CB} = \frac{T_{CB} \cdot L_{CB}}{G \cdot I_{pCB}} = \frac{200 \cdot 10^3 \cdot 1200}{27 \cdot 10^3 \left(\frac{\pi(25^4 - 21^4)}{2} \right)} = 0,029 \text{ rad} \cdot \frac{180^\circ}{\pi \text{ rad}} = 1,662^\circ$

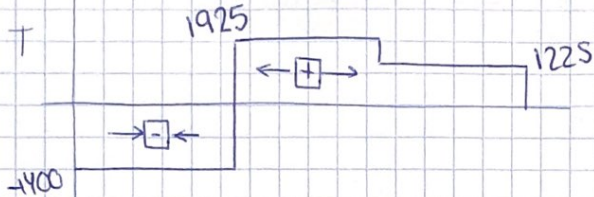
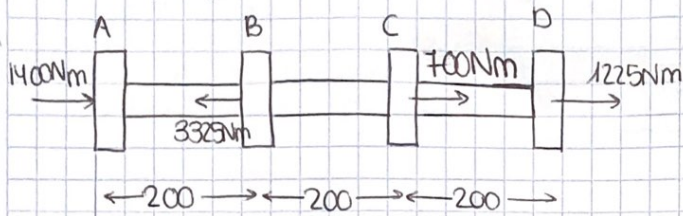


$\varphi_A = \varphi_B = \varphi_C + \varphi_{CB} = 4,756^\circ$

d) $\tau_{xy}^{CD} = \frac{T \cdot r}{\left(\frac{\pi r^4}{2} \right)} \rightarrow 40,57 = \frac{500 \cdot 10^3 \cdot r}{\left(\frac{\pi r^4}{2} \right)} \rightarrow \left(40,57 \cdot \frac{\pi}{2} \right) r^4 = 500 \cdot 10^3 r \rightarrow$

$\hookrightarrow r(63,73r^3 - 500 \cdot 10^3) = 0 \rightarrow 63,73r^3 = 500 \cdot 10^3 \rightarrow r = 18,87 \text{ mm} \rightarrow \Phi = 37,74 \text{ mm}$

$$G = 70 \text{ GPa}; \tau_{\text{onar}} = 70 \text{ MPa}$$



$$a) \tau_{\text{onar}} = 70 \text{ MPa} \rightarrow \tau_{\text{onar}} = \frac{T_{\text{max}} r}{\frac{\pi r^4}{2}} \rightarrow 70 = \frac{1925 \cdot 10^3}{\frac{\pi r^3}{2}} \rightarrow \phi = 51,93 \text{ mm}$$

$$b) \varphi_{AB} = \frac{T_{AB} \cdot L_{AB}}{G \cdot I_p} = \frac{-1400 \cdot 10^3 \cdot 200}{70 \cdot 10^3 \cdot 7,14 \cdot 10^5} = -0,0056 \text{ rad} = -0,32^\circ$$

$$\varphi_{BC} = \frac{1925 \cdot 10^3 \cdot 200}{70 \cdot 10^3 \cdot 7,14 \cdot 10^5} = 0,0077 \text{ rad} = 0,44^\circ$$

$$\varphi_{CD} = \frac{1225 \cdot 10^3 \cdot 200}{70 \cdot 10^3 \cdot 7,14 \cdot 10^5} = 0,0049 \text{ rad} = 0,28^\circ$$

$$\varphi_B = \varphi_{AB} = -0,32^\circ$$

$$\varphi_C = \varphi_B + \varphi_{BC} = 0,12^\circ$$

$$\varphi_D = \varphi_C + \varphi_{CD} = 0,4^\circ$$