

ИСХОДНЫЕ ДАННЫЕ

$$n_{об_быс} := 200 \frac{об}{мин}$$

$$M_{кр_быстр1} := 2500 \frac{г}{см}$$

$$M_{кр_быстр} := M_{кр_быстр1} \cdot 0.00009807 = 0.245$$

$$u_{ред} := 21$$

$$M_{кр_тих} := u_{ред} \cdot M_{кр_быстр} = 5.149 \frac{Н}{м}$$

$$\frac{n_{об_быс}}{(u_{ред} \cdot 60)} = 0.159 \frac{об}{сек}$$

$$z_1 := u_{ред} = 21$$

$$z_2 := z_1 + 1 = 22$$

$$\frac{500}{u_{ред} \cdot 60} = 0.397 \frac{об}{сек}$$

$$K_H := 1.15 \quad Z_c := 1 \quad \text{пусть будут один саттелита}$$

особое легкое нагружение

$$T := K_H \cdot \frac{M_{кр_тих}}{Z_c} \quad k_H := 0.18 \quad K_E := 0.21 \quad \text{очень сильно занижены!!!!}$$

$$T_E := k_H \cdot T = 1.066$$

$$\lambda_1 := \sqrt[4]{\frac{z_1}{3.7 \cdot (z_1 + 4)}} = 0.69 \text{ норм}$$

$$\sigma_H := 1100 \text{ МПа}$$

$$\psi_b := 0.15$$

$$d_2 := \text{Ceil} \left[680 \cdot \sqrt[3]{\left(\frac{T_E \cdot z_2}{\lambda_1^2 \cdot \psi_b \cdot z_1 \cdot \sigma_H^2} \right) \cdot [3.7 \cdot (z_1 + 4) \cdot \lambda_1^4 + z_1]}, 1 \right] = 56$$

$$e := \text{Ceil} \left[\left(0.5 \cdot d_2 \cdot \frac{\lambda_1}{z_2} \right), 0.1 \right] = 0.9 \text{ мм}$$

$$\lambda := \frac{2 \cdot e \cdot z_2}{d_2} = 0.707 \text{ норм} \quad \left[680 \cdot \sqrt[3]{\left(\frac{T_E \cdot z_2}{\lambda_1^2 \cdot \psi_b \cdot z_1 \cdot \sigma_H^2} \right) \cdot [3.7 \cdot (z_1 + 4) \cdot \lambda_1^4 + z_1]} \right] = 55.451 \text{ мм}$$

$$d_{цmin} := \frac{e \cdot z_1}{0.37 \cdot (z_1 + 4) \cdot \lambda^4 + z_1 \cdot 0.1} = 4.283$$

принимаю

$$d_{ц} := 5$$

$$i := 1, 2 \dots z_2$$

$$r_{\text{II}} := \frac{d_{\text{II}}}{2} = 2.5$$

$$d_1 := 2 \cdot e \cdot \frac{z_1}{\lambda} = 53.455$$

$$d_{\text{fI}} := d_2 - d_{\text{II}} - 2 \cdot e = 49.2$$

$$d_{\text{aI}} := d_{\text{fI}} + 4 \cdot e = 52.8$$

$$b := \psi_b \cdot d_2 = 8.4$$

$$h := 2 \cdot e = 1.8$$

$$\rho_a := \frac{e \cdot z_2 \cdot (1 + \lambda)^3}{\lambda + \lambda^2 \cdot (z_2 + 1) + \lambda^3 \cdot z_2} - r_{\text{II}} = 2.428$$

$$p_f := \left[\frac{e \cdot z_2 \cdot (1 + \lambda)^3}{\lambda + (\lambda)^2 \cdot (z_2 + 1) + \lambda^3 \cdot z_2} \right] + r_{\text{II}} = 7.428$$

$$R_{\rho 1} := (0.85) \cdot (e \cdot z_1) = 16.065$$

$$R_{\rho 2} := (1.1) \cdot (e \cdot z_1) = 20.79$$

$$R_{\rho} := \frac{37}{2} = 18.5$$

$$\tau_i(i) := \frac{2 \cdot \pi \cdot i}{z_2}$$

$$x_{\text{ci}}(i) := \left(\frac{e \cdot z_2}{\lambda} \right) \cdot \cos(\tau_i(i)) - e$$

$$y_{\text{ci}}(i) := \left(\frac{e \cdot z_2}{\lambda} \right) \cdot \sin(\tau_i(i))$$

$$\varphi_i(i) := \operatorname{atan} \left[\frac{-(\sin(\tau_i(i)))}{\cos(\tau_i(i)) - \lambda} \right]$$

$$x_{\text{ki}}(i) := x_{\text{ci}}(i) - r_{\text{II}} \cdot \cos(\varphi_i(i))$$

$$y_{\text{ki}}(i) := y_{\text{ci}}(i) + r_{\text{II}} \cdot \sin(\varphi_i(i))$$

$$y_1(i) := y_{\text{ci}}(i) + \frac{y_{\text{ki}}(i) - y_{\text{ci}}(i)}{x_{\text{ki}}(i) - x_{\text{ci}}(i)}$$

$$x_i := e \cdot z_1$$

	$x_{\text{ki}}(i) =$	$y_{\text{ki}}(i) =$	$x_{\text{ci}}(i) =$	$y_{\text{ci}}(i) =$
	24.298	6.026	25.966	7.889
	22.053	12.711	22.655	15.138
	17.264	23.655	17.436	21.161
	9.968	27.85	10.732	25.47
	1.846	29.886	3.085	27.715
	-6.513	29.612	-4.885	27.715
	-14.474	27.044	-12.532	25.47
	-21.422	22.374	-19.236	21.161
	-26.815	15.962	-24.455	15.138
	-30.231	8.305	-27.766	7.889
	-31.4	$1.669 \cdot 10^{-14}$	-28.9	$1.586 \cdot 10^{-14}$
	-30.231	-8.305	-27.766	-7.889
	-26.815	-15.962	-24.455	-15.138
	-21.422	-22.374	-19.236	-21.161
	-14.474	-27.044	-12.532	-25.47
	...	...	...	...

$$P := \frac{2 \cdot \pi \cdot e}{\lambda} = 7.997$$

$$F_{\text{хисум}} := \left(1.2 \cdot \lambda - 0.66 + \frac{8}{z_2^2} \right) \cdot \frac{1000 \cdot T}{e \cdot z_1} = 64.254 \quad \text{Н}$$

$$F_{\text{уисум}} := -\frac{1000 \cdot T}{e \cdot z_1} = -313.279 \quad \text{Н} \quad \begin{array}{l} \text{принимаем} \\ z_p := 6 \end{array}$$

$$k_{\text{суммах}} := 1.33 \quad k_{\text{max}} := 0.67 \quad k_{\text{суммин}} := 1.16 \quad k_T := 0.42$$

$$F_{\text{рсуммах}} := k_{\text{max}} \cdot 1000 \cdot \frac{T}{R_\rho} = 214.435$$

$$F_{\text{рсум}} := k_{\text{суммах}} \cdot \left(1000 \cdot \frac{T}{R_\rho} \right) = 425.67$$

$$M := 7.8 \cdot 10^{-6} \cdot \left(\frac{\pi \cdot d_1^2}{4} \right) \cdot b = 0.147 \quad \text{кг}$$

$$n_1 := n_{\text{об_быс}} = 200 \quad n_2 := \frac{n_1}{u_{\text{ред}}} = 9.524$$

$$F_{\text{ин}} := M \cdot \left(\frac{\pi \cdot n_1}{30} \right)^2 \cdot e \cdot 10^{-3} = 0.058$$

$$F_r := \sqrt{(F_{\text{ин}} + F_{\text{хисум}} - F_{\text{рсуммах}})^2 + (F_{\text{уисум}})^2} = 347.392 \quad \text{Н}$$

Подшипники сателлита

$$k_{\text{с}} := 1.4 \quad \underline{V} := 1.2 \quad k_t := 1 \quad K_E \quad L_h := 10000 \quad \alpha_1 := 1 \quad \alpha_{23} := 0.55$$

$$P_r := V \cdot F_r \cdot k_{\text{с}} \cdot k_t = 583.618$$

$$n := n_1 + n_2 = 209.524$$

$$C_{\text{тр}} := K_E \cdot P_r \cdot \left(\frac{60 \cdot n \cdot L_h}{10^6 \cdot \alpha_1 \cdot \alpha_{23}} \right)^{0.3} = 625.251 \quad \text{Н}$$

$$2104 \text{ диаметр } 20 \text{ подшипника} \quad D := 28$$

$$C_r := 8800$$

$$d_{\text{fl}} = 49.2$$

$$P_r = 583.618 \quad 0.5 \cdot C_r = 4.4 \times 10^3 \quad \text{отлично}$$

$$D_{01} := 0.3 \cdot (d_{\text{fl}} - D) = 6.36$$

$$D_{02} := 0.45 \cdot (d_{f1} - D) = 9.54$$

$$D_0 := 4.8$$

$$d_B := D_0 - 2 \cdot e = 3$$

$$d_{p1} := 0.75 \cdot d_B = 2.25$$

$$d_{p2} := 0.85 \cdot d_B = 2.55$$

$$d_p := 3.7$$

$$\Delta := 0.0025 \cdot d_p = 9.25 \times 10^{-3}$$

расчет эксцентрикового зажима тисков

$$f_1 := 0.2 \quad \varphi_1 := \operatorname{atan}(f_1) = 0.197$$

$$f_2 := 0.2 \quad \varphi_2 := \operatorname{atan}(f_2) = 0.197 \quad e_1 := 1.25 \quad D_1 := 20$$

$$\alpha := \operatorname{atan}\left(2 \cdot \frac{e_1}{D_1}\right) = 0.124$$

$$\frac{D_1}{e_1} = 16$$

$$R_1 := \frac{D_1}{2 \cdot \cos(\alpha)} = 10.078 \quad s_1 := 6$$

$$A_1 := s_1 + R_1 \cdot \cos(\alpha) = 16 \quad d_{123} := 7$$

$$P_1 := 3 \quad H \quad L_1 := 50$$

$$e_1 = 1.25 \leq \quad R_1 \cdot f_1 + \frac{d_{123} \cdot f_2}{2} = 2.716$$

$$F_{123} := \frac{(P_1 \cdot L_1 \cdot \cos(\alpha))}{R_1 \cdot \tan(\alpha + \varphi_1) + \frac{d_{123} \cdot \tan(\varphi_2)}{2}} = 36.667$$

$$M_{\text{натяг}} := M_{\text{кр_тих}} \cdot 2 = 10.297 \quad f_3 := 0.35$$

