Moc wejściowa:

$P := 0.8$

$n_{wej} := 4500$

$u := 66$

$\mu := 0.9$

$M_z := 9550 \cdot \frac{P \cdot u \cdot \mu}{n_{wej}} = 100.848$

$k_0 := 17$

$\psi_b := 0.1$

$d_{obl} := \sqrt[3]{10^4 \cdot \frac{M_z}{k_0 \cdot \psi_b}} = 84.025$

przełożenie gdy koło sztywne jest nieruchome

$u = \frac{-z_1}{z_2 - z_1}$

$d_1 := d_{obl}$

$z_1 := 2 \cdot u = 132$

$m_{obl} := \frac{d_1}{z_1} = 0.637$

$m := 0.6$

$d_1 := m \cdot z_1 = 79.2$

$w_0 = (0.9 : -1.2) * m$

$w_{0min} := m \cdot 0.9 = 0.54$

$w_{0max} := m \cdot 1.2 = 0.72$

przyjmujemy $w_0 := 0.64$

$h_1 = (0.005 : -0.015) * d_1$

$h_{1min} := 0.005 \cdot d_1 = 0.396$

$h_{1max} := 0.015 \cdot d_1 = 1.188$

$h_1 := 0.824$

h_{c1}=(1.5:-2)*m

$h_{c1min} := 1.5 \cdot m = 0.9$

$h_{c1max} := 2 \cdot m = 1.2$

$h_{c1} := 1.034$

$x_1 := 3.39$

$h_a := 1$

$c := 0.35$

$\alpha := 20°$

$d_{f1} := m \cdot \left(z_1 - 2 \cdot h_a - 2 \cdot c + 2 \cdot x_1\right) = 81.648$

$d_{a1} := d_{f1} + 2 \cdot h_{c1} = 83.716$

$x_{.1} := \frac{d_{f1}}{2 \cdot m} - \frac{z_1}{2} + \left(h_a + c\right) = 3.39$

$d_w := d_{f1} - 2 \cdot h_1 = 80$

$\cos\alpha_y := m \cdot z_1 \cdot \frac{\cos(\alpha)}{d_{f1}} = 0.912$

$\alpha_y := \operatorname{acos}\left(\cos\alpha_y\right) = 24.284 \cdot °$

$\operatorname{inv}\alpha_y := \tan\left(\alpha_y\right) - \alpha_y \cdot \frac{\pi}{180°} = 0.027$

dla kąta α=20

$\operatorname{inv}\alpha := \tan(\alpha) - \alpha \cdot \frac{\pi}{180°} = 0.015$

$S_{f1} := d_{f1} \cdot \left(\frac{\pi}{2 \cdot z_1} + 2 \cdot x_1 \cdot \frac{\tan(\alpha)}{z_1} + \operatorname{inv}\alpha - \operatorname{inv}\alpha_y \right) = 1.482$

$S_{f1} = 1.482$

$d_{a1} = 83.716$

$\cos\alpha_{ya} := m \cdot z_1 \cdot \frac{\cos(\alpha)}{d_{a1}} = 0.889$

$\alpha_{ya} := \operatorname{acos}\left(\cos\alpha_{ya}\right) = 27.252 \cdot °$

$\operatorname{inv}\alpha_{ya} := \tan\left(\alpha_{ya}\right) - \left(\alpha_{ya} \cdot \frac{\pi}{180°} \right) = 0.039$

$\operatorname{inv}\alpha = 0.015$

$$S_{a1} := d_{a1}\cdot\left(\frac{\pi}{2\cdot z_1} + 2\cdot x_1\cdot\frac{\tan(\alpha)}{z_1} + \text{inv}\alpha - \text{inv}\alpha_{ya}\right) = 0.507$$

$b_1 := (0.1 \div 0.3)d_1$

$b_{1min} := d_1\cdot 0.1 = 7.92$ $\quad b_{1max} := 0.3\cdot d_1 = 23.76$

przyjęto

$b_1 := 11$

$a := (0.15 \div 0.25)\cdot b_1$ $\quad a_{min} := 0.15\cdot b_1 = 1.65$

$a_{max} := 0.25\cdot b_1 = 2.75$

przyjęto $a := 2$

$b_w \geq 2\cdot b_1 + 3mm$

przyjęto

$b_w := 2\cdot b_1 + 3 = 25$

$L := b_w + 2\cdot a = 29$

Oblczenia wyrzymalosciowe kola podatnego

$$K_s := \frac{S_{f1}}{\pi\cdot m} = 0.786$$

$h_2 := h_1 + m = 1.424$

$$Y := 1 - K_s\cdot\left[1 - \left(\frac{h_1}{h_2}\right)^2\right] = 0.477$$

wspolczynniki do rownania

$K_H := 1.2$

$C_\sigma := 1.4$

$E := 2.1\cdot 10^5$

$R := \frac{d_w + h_1}{2} = 40.412$

$$\sigma_y := K_H\cdot C_\sigma\cdot w_0\cdot h_1\cdot\frac{E}{R^{2\cdot Y}} = 5.46\times 10^3$$

$\sigma_y := 111.93$

$K_{sk} := 0.25$

$$\tau_s := \frac{M_z \cdot 10^3}{2 \cdot K_{sk} \cdot \pi \cdot R^2 \cdot h_1} = 47.709$$

$$z_E := 0.2 \cdot z_1 = 26.4$$

$$\sigma_r := \frac{10^3 \cdot M_z}{2 \cdot b_w \cdot R \cdot h_1 \cdot z_E} = 2.294$$

Koło podatne wykonane ze stali 35HGS

$R_m := 1620$

$Z_{go} := 0.5 \cdot R_m = 810$

$Z_{so} := 0.55 \cdot Z_{go} = 445.5$

$K_\sigma := 1.9$ $\sigma_{ra} := 0.5 \cdot \sigma_r = 1.147$

$\sigma_m := 0.5\sigma_r = 1.147$

$\sigma_a := \sigma_y + \sigma_{ra} = 113.077$ $\psi_\sigma := 0.15$

$$\delta_g := \frac{Z_{go}}{K_\sigma \cdot \sigma_a + \psi_\sigma \cdot \sigma_m} = 3.767$$

$K_\tau := (0.7 \div 0.8) \cdot K_\sigma = 1.662$ $\tau_{sa} := 0.5 \cdot \tau_s = 23.854$

$\psi_\tau := 0.15$ $\tau_{sm} := 0.5 \cdot \tau_s = 23.854$

$$\delta_s := \frac{Z_{so}}{K_\tau \cdot \tau_{sa} + \psi_\tau \cdot \tau_{sm}} = 10.304$$

$$\delta := \frac{(\delta_g \cdot \delta_s)}{\sqrt{\delta_g^2 + \delta_s^2}} = 3.538$$

$\delta > 1.5 = 1$

Parametry geometryczne kola podatnego

Maksymalne przemieszczenie w dużej osi generatora

Liczba zębów

itd...

Obliczanie parametrów koła sztywnego

$m = 0.6$

$d_{a0} := 31.662$

$z_0 := 60$

$h_{a0} := 1.25$

$a_{w0} := m\cdot\left(z_1 + z_0\right)\cdot\frac{\cos(\alpha)}{2\cdot\cos\left(\alpha_{w0}\right)}$

$inv\alpha_{w0} := 2\cdot\frac{x_1 + x_2}{\left(z_1 + z_0\right)}\cdot\tan(\alpha) - inv\alpha = 0.011$

$\alpha_{w0} := 18.17°$

$x_2 := x_1 - \left(1 - \frac{w_0}{m}\right) = 3.457$

$x_0 := \frac{d_{a0}}{2\cdot m} - \frac{z_0 + h_{a0}}{2} = -4.24$

$x_0 := 4.24$

$a_{w0} := \frac{\cos(\alpha)\cdot m\cdot\left(z_1 + z_0\right)}{2\cdot\cos\left(\alpha_{w0}\right)} = 56.967$

lojkijhkhkjhjhghfdg

$a_{w00} := 26.87$

$d_{f2} := 2\cdot\left(a_{w0} + 0.5\cdot d_{a0}\right) = 145.596$

$h_{wmin} := 1.3\cdot m = 0.78$

$z_2 := z_1$

$h_{wmax} := 1.6\cdot m = 0.96$

przyjęto:

$h_w := 0.879$

$d_{a2} := d_{a1} + 2\cdot w_0 - 2\cdot h_w = 83.238$

$d_{a1} \le d_{k2} - 2\cdot w_0$

$$d_{k2} := m \cdot z_2 \cdot \frac{\cos(\alpha)}{\cos(\alpha_{k2})}$$

$$\cos\alpha_{a0} := m \cdot z_0 \cdot \frac{\cos(\alpha)}{d_{a0}} = 1.068$$

$$\alpha_{a0} := \operatorname{acos}(\cos\alpha_{a0}) = 21.079i \cdot °$$

$$tg\alpha_{k2} := \tan(\alpha_{w0}) + \frac{z_0}{z_2} \cdot (\tan(\alpha_{a0}) - \tan(\alpha_{w0})) = 0.181 + 0.158i$$

$$\alpha_{k2} := \operatorname{atan}(tg\alpha_{k2}) = (10.521 + 8.809i) \cdot °$$

$$d_{k2} := m \cdot z_2 \cdot \frac{\cos(\alpha)}{\cos(\alpha_{k2})} = 75.883 + 2.15i$$

$$d_{a1} = 83.716$$

$$d_{k2} = 75.883 + 2.15i$$

$$d_{k2} - 2 \cdot w_0 = 74.603 + 2.15i$$

asfdafafasfasfasfasfasfasfas

$$d_{a1} \le d_{k2} - 2 \cdot w_0 =$$

next

$$d_{a2} \ge d_{k1} - 2 \cdot w_0$$

$$\rho_0 := 0.3$$

$$d_{k1} := m \cdot z_2 \cdot \frac{\cos(\alpha)}{\cos(\alpha_{k1})}$$

$$tg\alpha_{k1} := \tan(\alpha) - \frac{4 \cdot (h_a + c - \rho_0 - x_1)}{z_1 \cdot \sin(2 \cdot \alpha)} = 0.474$$

$$\alpha_{k1} := \operatorname{atan}(tg\alpha_{k1}) = 25.374 \cdot °$$

$$d_{k1} := m \cdot z_2 \cdot \frac{\cos(\alpha)}{\cos(\alpha_{k1})} = 83.618$$

$$d_{k1} = 83.618$$

$$d_{a2} = 83.238$$

$$d_{k1} - 2 \cdot w_0 = 82.338$$

$$d_{a2} \ge d_{k1} - 2 \cdot w_0 = 1$$

PARAMETRYgeometryczne kola

$\varphi := 0°$

$\varphi_2 := \frac{\frac{\pi}{2} - \varphi}{u} = 0.024$

$r_{a1} := \frac{d_{a1}}{2} = 41.858$

Wspolrzedne trajektorii punktu M

$v_{a1} := v + (r_{a1} - R)\cdot\Theta - (r_{a1} + w)\cdot\varphi_2$

$w_{a1} := (r_{a1} + w)\cdot\cos(\varphi_2) - R$

$r_{f1} := \frac{d_{f1}}{2} = 40.824$

dla

$w := w_0\cdot\cos(2\cdot\varphi)$

$v := -0.5\cdot w_0\cdot\sin(2\cdot\varphi)$

$\Theta := 1.5\cdot\frac{w_0}{R}\cdot\sin(2\cdot\varphi)$

$v_{f1} := v + (r_{f1} - R)\cdot\Theta - (r_{f1} + w)\cdot\varphi_2$

$R = 40.412$

$w_{f1} := (r_{f1} + w)\cdot\cos(\varphi_2) - R$

Rysunek

Obliczanie grubości koła sztywnego

$\cos\alpha_{y2} := \frac{m\cdot z_2\cdot\cos(\alpha)}{d_{a2}} = 0.908$

$\alpha_{y2} := \operatorname{acos}(\cos\alpha_{y2}) = 24.817\cdot°$

$\operatorname{inv}\alpha_{y2} := \tan(\alpha_{y2}) - \left(\alpha_{y2}\cdot\frac{\pi}{180°}\right) = 0.029$

$\operatorname{inv}\alpha = 0.015$

$S_{a2} := d_{a2}\cdot\left(\frac{\pi}{2\cdot z_2} - \frac{2\cdot x_2\cdot\tan(\alpha)}{z_2} - \operatorname{inv}\alpha + \operatorname{inv}\alpha_{y2}\right) = 0.61$

$$\cos\alpha_{y2} := \frac{m \cdot z_2 \cdot \cos(\alpha)}{d_{f2}} = 0.519$$

$$\alpha_{y2} := \operatorname{acos}\left(\cos\alpha_{y2}\right) = 58.741 \cdot °$$

$$\operatorname{inv}\alpha_{y2} := \tan\left(\alpha_{y2}\right) - \left(\alpha_{y2} \cdot \frac{\pi}{180°}\right) = 0.622$$

Dla kąta 20º

$$\operatorname{inv}\alpha = 0.015$$

$$S_{f2} := d_{f2} \cdot \left(\frac{\pi}{2 \cdot z_2} - \frac{2 \cdot x_2 \cdot \tan(\alpha)}{z_2} - \operatorname{inv}\alpha + \operatorname{inv}\alpha_{y2}\right) = 87.382$$

Wyznaczanie drogi względnej koła podatnego stopnia przekładiowego
Współrzędne punktu A:

$$v_{a1s} := v + \left(r_{a1} - R\right) \cdot \Theta$$

$$w_{a1s} := \left(r_{a1} + w\right) - R$$

Współrzędne punktu B:

$$v_{f1s} := v + \left(r_{f1} - R\right) \cdot R$$

$$w_{f1s} := \left(r_{f1} + w\right) - R$$

TABELA

Obliczanie współczynnika pzesunięcia zarysu zębów koła sztywnego stopnia sprzęgłowego.

$$v_{a1smax} := -0.81$$

$$S_{a1s} := S_{a1}$$

$$j_t := 0.05 \cdot m = 0.03$$

$$z_{2s} := 242$$

$$x_{2s} := 1.5 \cdot x_1 = 5.085$$

$$d_{f2s} := d_{f2}$$

$$e_{y2s} := 2 \cdot \left(j_t + \frac{S_{a1s}}{2} + v_{a1smax}\right)$$

$$\cos\alpha_{ysm} := \frac{m \cdot z_{2s} \cdot \cos(\alpha)}{d_{f2s}} = 0.937$$

$$\alpha_{ysm} := \operatorname{acos}\left(\cos\alpha_{ysm}\right) = 20.424 \cdot °$$

$$\mathrm{inv}\alpha_{ysm} := \tan(\alpha_{ysm}) - \alpha_{ysm}\cdot\frac{\pi}{180°} = 0.016$$

$$S_{y2s} := d_{f2s}\cdot\left(\frac{\pi}{2\cdot z_{2s}} - \frac{2\cdot x_{2s}\cdot\tan(\alpha)}{z_{2s}} - \mathrm{inv}\alpha + \mathrm{inv}\alpha_{ysm}\right) = -1.136$$

$$x_{2s} := \left(\frac{-\pi}{2\cdot z_{2s}} + \frac{e_{y2s}}{d_{f2s}} - \mathrm{inv}\alpha + \mathrm{inv}\alpha_{ysm}\right)\cdot\frac{z_{2s}}{2\cdot\tan(\alpha)} = -4.256$$

$$x_0 := \frac{d_{a0}}{2\cdot m} = 26.385$$

$$\mathrm{inv}\alpha_{w0} := 2\cdot\frac{(x_{2s} - x_0)}{z_{2s} - z_0}\cdot\tan(\alpha) + \mathrm{inv}\alpha = -0.108$$

$$a_{w0} := \frac{m\cdot(z_{2s} - z_0)\cdot\cos(\alpha)}{2\cdot\cos(\alpha_{w0})} = 54$$

$$d_{f2} := 2\cdot(a_{w0} + 0.5\cdot d_{a0}) = 139.662$$

$$d_{a2s} := d_{a1} + 2\cdot w_0 - 2\cdot h_w = 83.238$$

parametry geometryczne koła podatnego

maksymalne przemieszczenie w dużej osi generatora $w_0 = 0.64$

liczba zębów $z_1 = 132$

Moduł $m = 0.6$

Kąt zarysu $\alpha = 20 \cdot °$

współczynnik przesunięcia zarysu $x_1 = 3.39$

średnica wierzchołków koła $d_{a1} = 83.716$

średnica podstaw koła $d_{f1} = 81.648$

szerokość wieńca zębatego $b_w = 25$

długość korpusu koła $L = 29$

długość korpusu pod uzębieniem $h_1 = 0.824$

Materiał 35HGS -

parametry geometryczne koła sztywnego

$z_2 = 134$

$m = 0.6$

$\alpha = 20 \cdot °$

$x_2 = 3.457$

$d_{a2} = 83.238$ średica wierzchołków koła

$d_{f2} = 139.662$ średnica podstaw koła

Materiał 42CrMo4

Parametry geometryczne koła sztywnego sprzęgła

$z_2 = 134$

$m = 0.6$

$x_{2s} = -4.256$ 4.5 ??????

$d_{a2} = 83.238$

$d_{f2} = 139.662$

materiał 42CrMo4

$j := \cos(\alpha) \cdot m \cdot \left(z_1 + z_0\right) = 108.253$

$hh := 2 \cdot \cos\left(\alpha_{w0}\right) = 1.9$

$+ 2 = 134$