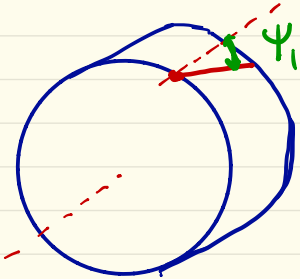
بسم الله الرحمن الرحیم

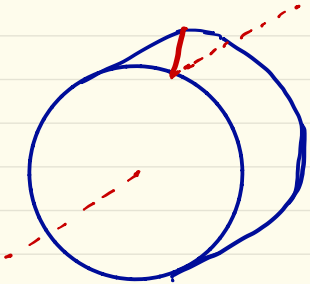
چرخ دنده های حلزونی

طراحی اجزاء II

جلسه ۲۴

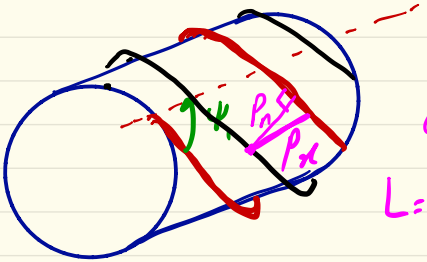


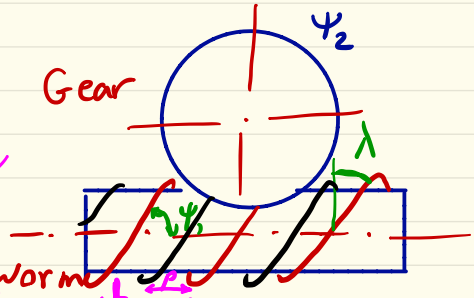
راست گرد ψ_1



چپ گرد ψ_2

$\Sigma = \psi_1 + \psi_2$ زاویه بین دو شافت





گام محوری

$L = N_w \cdot p$

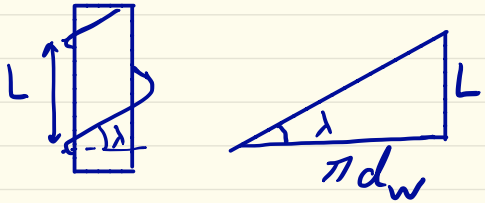
λ : زاویه پیچ

ψ_1 : زاویه هلیس

$$\Leftarrow \begin{cases} \lambda + \psi_1 = 90^\circ \\ \psi_1 + \psi_2 = 90^\circ \end{cases}$$

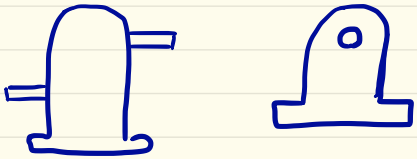
$\lambda = \psi_2$

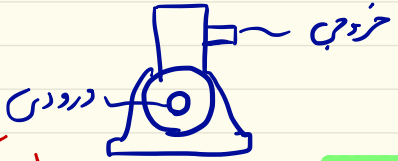
$N_w =$ تعداد تیغ پیچ



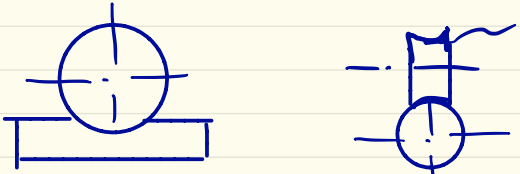
$$\operatorname{tg}\lambda = \frac{L}{\pi d_w}$$

نسبت سرعت $m_G = \dfrac{N_G}{N_W}$

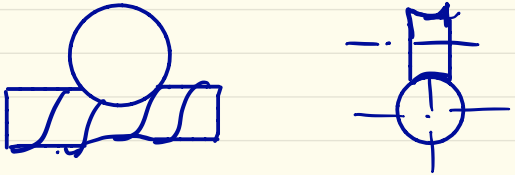




(حلزونی)

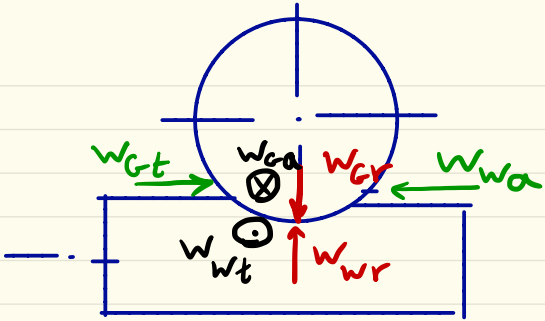


۱- درگیری یک طرفه



۲- درگیری دو طرفه

تحلیل نیروی :



$$\begin{cases} W_{Wr} = W_{Gr} = W \sin\phi_n \\ W_{Wt} = W_{Ga} = W \cos\phi_n \sin\lambda \\ W_{Wa} = W_{Gt} = W \cos\phi_n \cos\lambda \end{cases}$$

$$\begin{cases} W_{Wa} = W_{Gt} = W(\cos\phi_n \cos\lambda - \mu \sin\lambda) \\ W_{Wr} = W_{Gr} = W \sin\phi_n \\ W_{Wt} = W_{Ga} = W(\cos\phi_n \sin\lambda + \mu \cos\lambda) \end{cases}$$

$$F_f = W_f = \mu \cdot W = \frac{\mu W_{Gt}}{\mu \sin\lambda - \cos\phi_n \cos\lambda}$$

۱- اگر Worm محرک باشد:

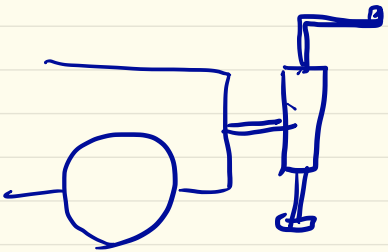
$$W_{wt} = W_{Gt} \underbrace{\frac{\cos\phi_n \sin\lambda + \mu \cos\lambda}{\mu \sin\lambda - \cos\phi_n \cos\lambda}}_{\text{منفی}}$$

۲- اگر Gear محرک باشد:

ناممکن

$$\begin{cases} \phi_n = 20^\circ \\ \lambda = 7^\circ \\ \mu = 0.2 \end{cases}$$

$$W_{wt} = W_{Gt} \underbrace{\frac{\cos\phi_n \sin\lambda - \mu \cos\lambda}{\mu \sin\lambda + \cos\phi_n \cos\lambda}}_{\text{مثبت}}$$



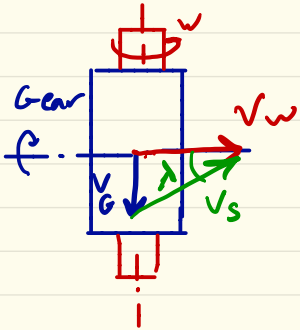
راندمان چرخ دنده های حلزونی :

توان تلف شده − توان ورودی = توان خروجی

$$\eta = \frac{\text{توان ورودی بدون اصطکاک}}{\text{توان ورودی با اصطکاک}} = \frac{\text{ترک ورودی بدون اصطکاک}}{\text{〃 〃 با 〃}} = \frac{W_{wt} \text{ بدون اصطکاک}}{\text{〃 〃 با 〃}}$$

$$\eta = \frac{\cos\phi_n - \mu \operatorname{tg}\lambda}{\cos\phi_n + \mu \operatorname{ctg}\lambda} \xrightarrow[\mu = 0.1]{\lambda = 7^\circ,\ \phi_n = 20^\circ} \eta = \%69.5$$

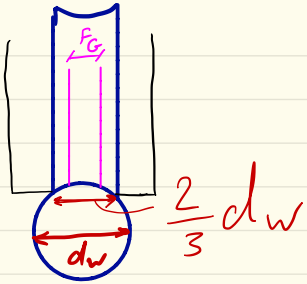
نکته ۱:



$$\vec{V_s} = \vec{V_w} - \vec{V_G}$$

$$V_s = \frac{V_w}{\cos\lambda}$$

نکته ۲:



$$F_e = \min\left[F_G, \frac{2}{3}d_w\right]$$