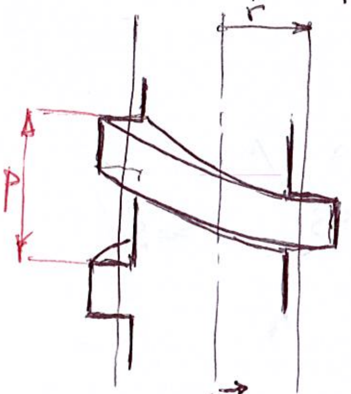
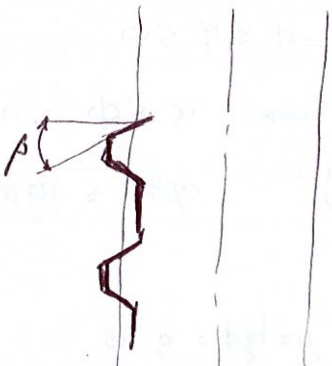
EN/US	FR	DE
thread	filetage	das Gewinde
bolt	boulon	der Bolzen, die Schraube
screw	vis	~~die Mutter~~
nut	écrou	die Mutter
pitch	pas	~~der~~ (Gewinde-)gang, die Steigung
wear	usure	Abnutzung
running in	rodage	Einschleifen
plagling	labourage	

efficiency = rendement = Wirkungsgrad.

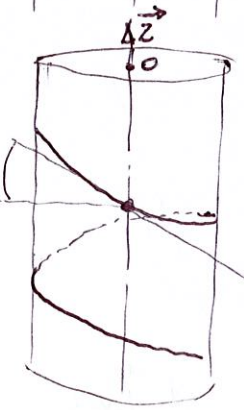
Thread with square profile



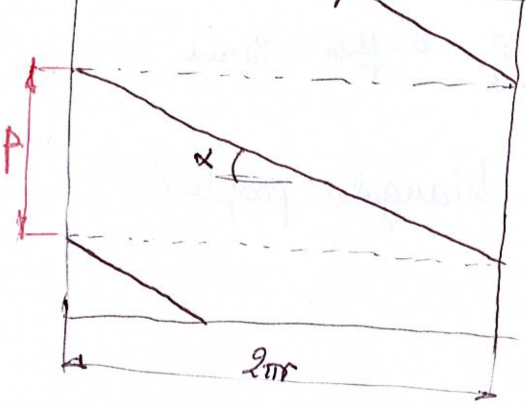
with triangular profile



(I)



standard: $\beta = 30°$

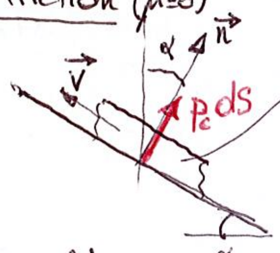


$$\operatorname{tg}\alpha = \frac{P}{2\pi r}$$

(II) Axial load W

axial torque $C = 2Q\frac{z}{2} = Qz$

1) No friction ($\mu = 0$)



thread part with a contact surface dS

p_c: contact pressure ($\neq$ fluid pressure)

equilibrium of the screw:
$$\begin{cases} \text{resultant}/\vec{z}: & W = \int_S p_c\,dS\cos\alpha = \cos\alpha\int_S p_c\,dS \\ \text{torque } o/\vec{z}: & C = \int_S p_c\,dS\sin\alpha\, r = r\sin\alpha\int_S p_c\,dS \end{cases}$$

$$\Rightarrow \boxed{C = r\operatorname{tg}\alpha . W}$$

2) With friction $\mu = \operatorname{tg}\phi$

$\varphi = \phi$ if screw up

$\varphi = -\phi$ if screw down

$$\begin{cases} W = \cos(\alpha+\varphi)\int_S p_c\,dS \\ C = r\sin(\alpha+\varphi)\int_S p_c\,dS \end{cases}$$

$$\Rightarrow \boxed{C = r\operatorname{tg}(\alpha+\varphi) . W}$$

For a given W, the hardest way is... to screw up

(III) 1) Efficiency

1 revolution → useful work $= W.P$, exerted work $= C.2\pi$ $\Rightarrow \boxed{\eta = \frac{WP}{2\pi C} = \frac{\operatorname{tg}\alpha}{\operatorname{tg}(\alpha+\varphi)}}$ for $\varphi \geq 0$, $\eta \leq 1$

screwing up: $\eta = \frac{\operatorname{tg}\alpha}{\operatorname{tg}(\alpha+\phi)}$ $\quad \frac{\partial\eta}{\partial\alpha} = 0 \Rightarrow \frac{\operatorname{tg}(\alpha+\phi)}{\cos^2\alpha} - \frac{\operatorname{tg}\alpha}{\cos^2(\alpha+\phi)} = 0 \Rightarrow \cos(\alpha+\phi)\sin(\alpha+\phi) = \cos\alpha\sin\alpha$

$\Rightarrow \sin 2(\alpha+\phi) = \sin 2\alpha$

$$\Rightarrow \boxed{\operatorname{tg}2\alpha = \frac{\sin 2\phi}{1-\cos 2\phi}}$$

Plus simple: $\Rightarrow \frac{\sin(\alpha+\phi)}{\cos\alpha} - \frac{\sin\alpha}{\cos(\alpha+\phi)} = 0$

$\Rightarrow \sin(2(\alpha+\phi)) = \sin 2\alpha$

Solution 1: $2(\alpha+\phi) = 2\alpha \Rightarrow \phi = 0$!

Solution 2: $\pi - 2(\alpha+\phi) = 2\alpha \Rightarrow \boxed{\alpha = \frac{\pi}{4} - \frac{\phi}{2}}$

Cric à vis

Arc-boutement - self-locking

W ≠ 0, $\begin{cases} Q = 0 \\ C = 0 \end{cases}$ mais pas de mouvement ?

→ peut-on avoir l'équilibre ? $C = r\,tg(\alpha+\varphi)W$ avec $-\phi \leq \varphi \leq \phi$ $(\mu = tg\phi)$

Il faut $tg(\alpha+\varphi) = 0$, 1 seule solution : $\varphi = -\alpha$ donc $\alpha \leq \phi$

$$\boxed{tg\alpha \leq \mu}$$

Pour les filets standards, $0{,}035 \leq tg\,\alpha \leq 0{,}053$

Conclusion ?