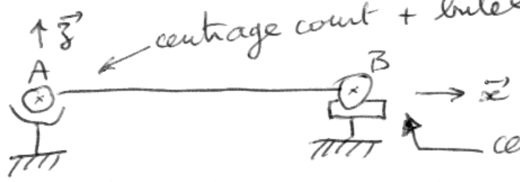
td ST5.1

17h20

(1)



centrage court + butée axiale

centrage court ($L \leq D$)

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(2) $p_{adm} = \dfrac{F_r}{L\,D} \Rightarrow \boxed{F_r = p_{adm}\,L.D}$ $\quad F_r = 300.10^5.\underbrace{10^{-2}\,2\,10^{-2}}_{10}$

$\underline{F_r = 6000\,N}$

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(3) $C_T = F_T \cdot \dfrac{D_r}{2}$

17h31 $F_R = F_T \tan\alpha_n \cos\delta$

$\Rightarrow \boxed{C_T = \dfrac{F_R}{\tan\alpha_n \cos\delta}\,\dfrac{D_r}{2}}$ $\quad C_T = \dfrac{6000 \cdot 0{,}036}{\tan 20 \cos 45 \cdot 2}$

$\underline{C_T = 420\,Nm}$

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(4) $\left.\begin{array}{l} F_A = F_T \tan\alpha_n \sin\delta \\ F_R = F_T \tan\alpha_n \cos\delta \end{array}\right\} \Rightarrow \dfrac{F_A}{F_R} = \tan\delta$ $\quad \boxed{F_A = F_R \tan\delta}$

$F_A = 6000 \cdot \underbrace{\tan 45°}_{=1}$

$\underline{F_A = 6000\,N}$

17h33

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(5) $\vec{df} = -\lambda\,dl\,\vec{n} + \lambda f\,dl\,.\vec{t}$ $\quad$ avec $\boxed{\lambda = p_{adm}\dfrac{D_c - D}{2}}$

$\lambda = 300.10^5\,\dfrac{30-20}{2}\,.10^{-3}$

$\underline{\lambda = 150\,kN/m}$

$\vec{df} = -\lambda\,\dfrac{D_c}{2}\,d\theta\,(-\vec{x}) + \lambda f\,\dfrac{D_c}{2}\,d\theta\,\vec{e_\theta}$

$\boxed{\vec{df} = \lambda\dfrac{D_c}{2}\,d\theta\left(\vec{x} + f\,\vec{e_\theta}\right)}$

17h42

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(6) avec $\vec{e_\theta} = \cos\theta\,\vec{y} + \sin\theta\,\vec{z}$

$\vec{F} = \displaystyle\int_{\theta=0}^{\theta=2\pi} \lambda\,\dfrac{D_c}{2}\,d\theta\,\left(\vec{x} + f\left(\cos\theta\,\vec{y} + \sin\theta\,\vec{z}\right)\right)$

$= \lambda\,\dfrac{D_c}{2}\left[\theta\,\vec{x} + f\left(\sin\theta\,\vec{y} - \cos\theta\,\vec{z}\right)\right]$

17h42

$x \quad y \quad z$

$x \quad e_r \quad e_\theta$

(6) $\vec{Cf} = \int_{\theta=0}^{\theta=2\pi} \vec{AM} \wedge \vec{df} = \int_{\theta=0}^{\theta=2\pi} \frac{D_c}{2}\vec{e_r} \wedge \partial \frac{D_c}{2} d\theta(\vec{x} + f\vec{e_\theta})$

$= \int_{\theta=0}^{\theta=2\pi} \partial \frac{D_c^2}{4} (-\vec{e_\theta} + f\vec{x})\, d\theta$

avec $\vec{e_\theta} = \cos\theta\, \vec{y} + \sin\theta\, \vec{z}$

$= \partial \frac{D_c^2}{4} \int_{\theta=0}^{\theta=2\pi} -\cos\theta\, \vec{y} - \sin\theta\, \vec{z} + f\vec{x}\, d\theta$

$= \partial \frac{D_c^2}{4} \Big[\underbrace{-\sin\theta\, \vec{y} + \cos\theta\, \vec{z}}_{\text{nul car périodique}} + f\theta\vec{x} \Big]_0^{2\pi}$ $\begin{cases} \sin(2\pi) = \sin(0) \\ \cos(2\pi) = \cos(0) \end{cases}$

$\vec{Cf} = \partial \frac{D_c^2}{4} . f\, 2\pi \vec{x}$

donc $\boxed{Cf = \partial \frac{D_c^2 \pi f}{2}}$ $\quad Cf = \frac{150.10^3 .\ 0{,}036^2\ \pi .0{,}1}{2}$

$Cf =$ 21,2 Nm

17h52

(7) $\boxed{\eta = \frac{Ct - Cf}{Ct}}$ $\quad \eta = \frac{420 - 30}{420}$ $\quad \eta =$ 0,95

de l'ordre de grandeur du rendement de l'engrènement $\eta_c = 0{,}96$

(8) $(pV) = p . \frac{D_c}{2} . \omega = p \frac{D_c}{2} \frac{\pi N}{30}$

pV : [MPa.m/s] = [N/mm².m/s] =[W/mm²]

$pV: \left[\frac{N}{(10^{-3}m)^2} . \frac{m}{s}\right] = [10^6 N.m^{-1}s^{-1}]$

d'où $\boxed{N = \frac{60.(pV)_{adm}}{p\pi D_c}}$

$N = \frac{60.3{,}5.10^6}{300.10^5.\pi.0.03}$

$N = 74{,}3\ tr.min^{-1}$

(9) $\boxed{P_u = Ct.\eta.\eta c\ N \frac{\pi}{30}}$ $\quad P_u =$ 420.0,95.0,96.74,3.3,14/30

$P_u =$ 2980 W