Correction du TD Th Ec sur le générateur de houle :

Q1 $\vec{V}_{M\in 7/0} = \underset{\vec{0}}{\underset{\parallel}{\vec{V}_{O\in 7/0}}} + \vec{MO} \wedge \vec{\Omega}_{7/0}$

$= -u\,\vec{y}_7 \wedge \dot{\theta}\,\vec{z}_7 = -u\dot{\theta}\,\vec{x}_7$ $\boxed{\vec{V}_{M\in 7/0} = -\frac{u}{b}\frac{d\lambda}{dt}\,\vec{x}_7}$

$d\vec{F} = dS\,\Delta p(M)\,\vec{x}_7 = dS \times \frac{1}{2} \times \|\vec{V}_{M\in 7/0}\|^2 \rho\,\vec{x}_7$

$= dS \times \frac{1}{2}\rho u^2 \dot{\theta}^2\,\vec{x}_7$

$\boxed{d\vec{F} = \frac{\rho u^2 \dot{\theta}^2}{2}\,dS\,\vec{x}_7}$ $\boxed{d\vec{F} = \frac{\rho u^2}{2b^2}\frac{d\lambda}{dt}\,dS\,\vec{x}_7}$

Alors $dP(M) = \vec{dF(M)} \cdot \vec{V}_{M\in 7/0}$

$= -\frac{\rho u^2 \dot{\theta}^2}{2} \cdot u\,\dot{\theta}\,dS$

d'où $\boxed{dP(M) = -\frac{\rho u^3 \dot{\theta}^3}{2}\,dS}$

$$\boxed{dP(M) = \frac{-\rho u^3}{2b^3}\left(\frac{d\lambda}{dt}\right)^3 dS}$$

$\lambda(t) = \lambda_0 \sin(\omega_B t) + d$

$\dot{\lambda}(t) = \lambda_0 \omega_B \cos(\omega_B t)$

Q2 : $P_{e\to 7/0} = \displaystyle\int_{u=0}^{u=h} -\frac{\rho U^3}{2b^3}\left(\frac{d\alpha(t)}{dt}\right)^3 dS$

$$= \int_0^h -\frac{\rho U^3}{2b^3}\left(\alpha_0\omega_B\cos\omega_B t\right)^3 L\,du$$

$$= -\frac{\rho\alpha_0^3\omega_B^3\cos^3\omega_B t\,L}{2b^3}\int_0^h U^3\,du$$

$$= \frac{-\rho\alpha_0^3\omega_B^3\cos^3(\omega_B t)\,L}{2b^3}\,\frac{h^4}{4}$$

$$\boxed{P_{e\to 7/0}(t) = -\frac{\rho\alpha_0^3\omega_B^3 L h^4\cos(\omega_B t)^3}{8b^3}}$$

d'où $\boxed{P_{e\to 7/0\,MAX} = \dfrac{-\rho\alpha_0^3\omega_B^3 L h^4}{8b^3}}$

Q3 On étudie le système volet le théorème de l'Ec donne

$$\frac{dE_c}{dt} = \underset{\substack{\parallel\\0}}{P_{INT}} + P_{EXT}$$

$E_c = 0$ puisqu'on néglige la masse du volet.

$P_{Ext} = P_{e\to 7} + P_{vérin}$

$$P_{vérin} = \begin{Bmatrix}\vec{0}\\ \vec{V_B}\end{Bmatrix}_B \otimes \begin{Bmatrix}-F_V\vec{x}_0\\ \vec{0}\end{Bmatrix}_B = V_v F_v$$

donc l'application du théorème de l'E_c donne

$$0 = P_{e\to 7/0} + V_v F_v$$

$$\Rightarrow \quad F_v = -\frac{P_{e\to 7/0}}{V_v} = \frac{\rho k V_v^3}{V_v}$$

$$\boxed{F_v = \rho k V_v^2}$$

A.N. $\underline{F_v = 1000 \times 1{,}5 \times 2^2 = 1500 \times 4 = 6000\,N}$

Q4 $$S_v = \frac{\pi D^2}{4} - \frac{\pi d^2}{4} = \boxed{\frac{\pi(D^2-d^2)}{4} = S_v}$$

Le vérin a un rendement $\eta_3 = \dfrac{P_{sortie}}{P_{entrée}}$

$P_{sortie} = F_v V_v \qquad P_{entrée} = \Delta P_v \times Q$

$$\eta_3 \times \Delta P_v \times S_v \times \cancel{V_v} = F_v \cancel{V_v}$$

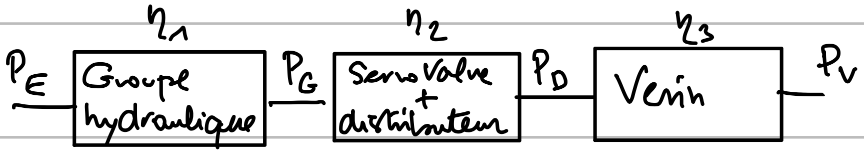
$$F_v = \eta_3 \Delta P_v \times S_v = \eta_3 \Delta P_v \times \frac{\pi(D^2-d^2)}{4}$$

$$F_v = 0{,}8 \times 50 \times 10^5 \times 10^{-2} = 0{,}8 \times 50 \times 10^3$$

$$= 4 \times 10^4\,N$$

Cette force est très largement suffisante au regard de la valeur calculer en Q3

Q5 :



on a $\frac{P_V}{P_D} = \eta_3$ $\quad \frac{P_D}{P_G} = \eta_2$ $\quad \frac{P_G}{P_E} = \eta_1$

d'où $\frac{P_V}{P_E} = \eta_3 \cdot \eta_2 \cdot \eta_1$

d'où $P_E = \frac{P_V}{\eta_3 \eta_2 \eta_1} = \frac{P_{e \to 7/0}}{\eta_3 \eta_2 \eta_1} \Rightarrow P_{E\,réelle} = c P_E$

$$\boxed{P_{E\,réelle} = \frac{c\, P_{e \to 7/0}}{\eta_3 \eta_2 \eta_1}} = \frac{4 \times 6 \times 10^3}{0{,}75 \times 0{,}5 \times 0{,}8}$$

$P_{E\,réelle} = 80\ kW < 90\ kW$ ☺

Fin