Correction EMD Hyd générale
2ST 2022

EX1 (5pts)

on applique l'équa° fondamental (1,5)

$P_A + w_e z_A = P_B + w_e z_B \Rightarrow P_A = P_B + w_e (z_B - z_A)$ (1)

$P_B = P_C$ (2) (0,5)

$P_C + w_{Hg} z_C = P_D + w_{Hg} z_D \Rightarrow P_C = w_{Hg} (z_D - z_C)$ ... (3) (1,5)

$P_A = w_{Hg}(z_D - z_C) + w_e (z_B - z_A)$ (0,5)

AN

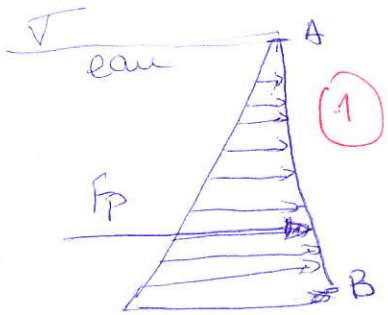
$P_A = 13,6 \cdot 10^3 \times 9,81 (3,80 - 3,00) + 9,81 \cdot 10^3 (3 - 3,60)$

$P_A = 100,84 \cdot 10^3$ Pa $= 1,008 \cdot 10^5$ Pa $= 1$ bar (1)

Exercice 2 (5pts)

2°) Calcul de F_p

$F_p = w h_G \cdot S = 10^3 \times 9,81 (2)(3 \times 4) = 23544$ N (2)



(1)

3°) Pt d'application

$y_p = y_G + \frac{I_{nG}}{S \times y_G} = 2 + \frac{16}{2 \times (3 \times 4)} = 2,66$ m (2)

Exercice 3 (10 pts)

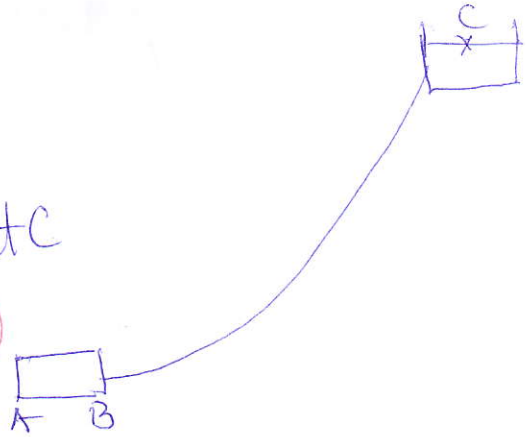
1°) Calcul de la puissance

$\mathcal{P} = w \cdot Hp \cdot Q$

Calcul de Hp

on applique l'équ° de Bernoulli entre A et C

$z_A + \frac{P_A}{w} + \frac{V_A^2}{2g} + Hp = z_C + \frac{P_C}{w} + \frac{V_C^2}{2g} + h_{AC}$ (1)



$Hp = z_C - z_A - \frac{P_A}{w} - \frac{V_A^2}{2g} + h_{BC}$ (0,5)

$h_{BC} = \lambda \cdot \frac{L}{D} \cdot \frac{V^2}{2g}$ (0,5) avec $V = \frac{4Q}{\pi D^2} = \frac{4 \times 0,197}{\pi (0,400)^2} = 1,57$ m/s (1)

$R_E = \frac{V \cdot D}{\nu} = \frac{1,57 \times 0,40}{5,16 \cdot 10^{-6}} = 1,21 \cdot 10^5$ (1)

$\frac{\varepsilon}{D} = \frac{0,18}{40} = 0,0045$ (1) D'après le diagramme de Moody $\Rightarrow \lambda = 0,032$ (1)

$Hp = 54 - 30 - \frac{0,14 \cdot 10^5}{9,81 \times 0,8 \cdot 10^3} + \frac{(1,57)^2}{2 \times 9,81} + 0,032 \times \frac{1800}{0,40} \times \frac{(1,57)^2}{2 \times 9,81} = 40,18$ m (0,5)

$\mathcal{P} = \frac{w Hp \cdot Q}{75} = \frac{0,8 \times 9,81 \cdot 10^3 \times 40,18 \times 0,197}{75} = 828$ ch (1)

Calcul de la pression P_B

2) Calcul de la pression P_B.

on applique l'équation de Bernoulli entre B et C

$$z_B + \frac{P_B}{w} + \frac{V_B^2}{2g} = z_C + \frac{P_C}{w} + \frac{V_C^2}{2g} - h_p + h_{BC} \quad (0,5)$$

($P_C = 0$, $V_C^2 = 0$)

$$\frac{P_B}{w} = z_C - z_B - \frac{V_B^2}{2g} - h_p + h_{BC}$$

$$\frac{P_B}{w} = 54 - 30 - \frac{(1,57)^2}{2 \times 9,81} - 40,18 + 18,09 = 1,78 \text{ m}$$

$$\Rightarrow P_B = w \times 1,78 = 0,8 \times 10^3 \times 9,81 \times 1,78 = \underline{0,14 \text{ bar}} \quad (0,5)$$

3°) Tracer la ligne piézométrique.

$$H_{piezA} = z_A + \frac{P_A}{w} = 30 + \frac{0,14 \cdot 10^5}{0,8 \cdot 9,81 \cdot 10^3} = 31,78 \text{ m} \quad (0,5)$$

$$H_{piezB} = H_{piezA} + H_p = 31,78 + 40,18 = 71,96 \text{ m} \quad (0,5)$$

$$H_{piezC} = H_{piezB} - h_{BC} = 71,96 - 18,09 = 53,87 \text{ m} \simeq 54 \text{ m}$$