Fiche TD N°04

Ex1 :

a) $F_r = \rho g h_c A = 1000 \times 9,81 \times \pi \times 2^2 \times 10$

$F_R = 123,27 \times 10^4$

$y_R = \frac{I_{xc}}{y_c . A} + y_c$

$I_{xc} = \frac{\pi r^4}{4} = 12,56\ m^4$

$\sin 60 = \frac{h_c}{y_c} \Rightarrow y_c = \frac{h_c}{\sin 60} = \frac{10}{\sin 60}$

$y_c = 11,54\ m$

$y_R = \frac{12,56}{11,54 \times \pi 2^2} + 11,54 = 11,62\ m$

b) $M(A) > M(F_R)$

$M(F_R) = y' . F_R = (y_R - y_c) F_R$

$M(F_R) = (11,62 - 11,54) \times 1,23 \times 10^6$

$M(F_R) = 98400\ N.m$

Ex 2 :

$F_R = \rho g h_c A = 9810 \times \left(8 \times \frac{4}{2}\right) \times \left(\frac{\pi \times 5}{2} \times 2\right)$

$F_R = 1,54 \times 10^6\ N$

$y_R = \frac{I_{xc}}{g_c \times A} + y_c =$

$I_{xc} = \frac{\pi a^3 b}{4} = \frac{\pi (2,5)^3 (2)}{4} = 24,54\ m^4$

$\sin\alpha = \frac{h_c}{y_c} \Rightarrow y_c = \frac{h_c}{\sin\alpha}$

$\alpha = ?$

$\sin\alpha = \frac{4}{5} = 0.8$

$y_c = \frac{10}{0.8} = 12.5\,m$

$y_R = \frac{24,54}{12,5 \times (\pi \times 2,5 \times 2)} + 12,5 = 12,62\,m$

$M(F_R) = M(F)$

$F_R(y_R - y') = \sum F$

$x = (y_R - y_c) + 2.5 = (12,62 - 12,5) + 2,5$

$x = 2,62\,m$

$\sin\theta = \frac{8}{y'} \Rightarrow y' = \frac{8}{0,8} = 10m$

$x = y_R - y' = 2,62\,m$

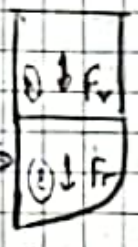
$F = \frac{1,54 \times 10^6 \times 2,62}{5} = 0,806 \times 10^6\,N$

Ex3.

$F_H = \rho g h_c A$ $\quad F_H = F_c$

$F_H = 9810 \times 14,4 \times (2 \times 4)$

$F_H = 9,81 \times 10^5\,N$



$y_R = \frac{I_{xc}}{y_c A} + y_c$

$I_{xc} = \frac{bh^3}{12} = \frac{1 \times 2^3}{12} = 0,66\,m^4$

$y_R = \frac{0,66}{5 \times 2 \times 1} + 5 = 5,066\,m$

$F_v = F_{v①} + F_{v②} = \rho V_1 g + \rho V_2 g$

$= \rho(2 \times 1 \times 4)g + \rho\left(\frac{\pi 2^2}{4} \times 1\right) \times g$

$F_v = 0,109 \times 10^6\,N$

Ex4

- calculating m

$\sum \vec{F} = \vec{0}$ $\quad W = F_{tp}$

$mg = P \cdot A$

$P = \rho g h_m + \rho g (h - 3)$

$mg = \rho g (h - 3) A \Rightarrow m = 32\rho = 32000\,kg$

- calculating R

$M(R) = M(F_R)$

$R \cdot 2 = F_R \cdot L'$

$F_R = \rho g h_c A = 1000 \times 9,81 \times \left(\frac{L}{2} + 5\right) \times 16$

$= 1000 \times 9,81 \times 7 \times 16$

$F_R = 1,09 \times 10^6\,N$

$y_R = \frac{I_{xc}}{y_c A} + y_c = \frac{\frac{ba^3}{12}}{\frac{4 \times 4^3}{12 \times 7 \times 16}} + 7$

$y_R = 7,19\,m$

$L' = R + L - y_R = 5 + 4 - 7,19 = 1,81\,m$

$R = \frac{F_R L'}{L} = \frac{1,09 \times 10^6 \times 1,81}{4}$

$R = 4,93 \times 10^5\,N$

Ex 5 :

$F_{en} = F_R - W = \rho g (\bar{h} S) - \rho V g$

Calculating F_H

$F_H = \rho g h_c A = 1000 \times 9,81 \times (2 + \frac{1}{2}) \times (1 \times 1)$

$F_H = 14715\ N$

$y_{FH} = \frac{I_{xc}}{y_c A} + y_c = \frac{1 \times 1^3}{12 \times 1,5 \times 1 \times 1} + 1,5$

$y_{FH} = 1,55\ m$

calculating F_V

$F_V = \rho V g = 1000 \times 9,81 \times [1 \times 1 \times 1 + \frac{\pi 1^2}{4} \times 1]$

$F_V = 17514,7\ N$

$F_T x = F_1 x_1 + F_2 x_2$

$\rho V_T g \cdot x = \rho V_1 g x_1 + \rho V_2 g x_2$

$V_T x = V_1 x_1 + V_2 x_2$ avec $z = 1m$

$S_T \times z \times x = S_1 z x_1 + S_2 z x_2$

$S_T x = S_1 x_1 + S_2 x_2$

$x = \frac{S_1 x_1 + S_2 x_2}{S_T}$ $x_2 = \frac{4R}{3\pi}$

$x = \frac{(1 \times 1) \times \frac{1}{2} + \frac{\pi 1^2}{4} \times \frac{4 \times 1}{3\pi}}{1 \times 1 + \frac{\pi 1^2}{4}}$

$x = 0,46\ m$

$F_T = \sqrt{F_V^2 + F_x^2} = 22875,662\ N$

Ex 2 :

$F_H = \rho g h_c A = 1000 \times 9,81 \times 3R \times 4R$

$F_H = 235440\ N$

$y_R = \frac{I_{xc}}{y_c A} + y_c = \frac{1 \times 4^3}{12 \times 6 \times 4 \times 1} + 6$

$y_R = 6,22\ m$

$F_V = \rho V g = 1000 \times 9,81 \times \frac{\pi R^2}{2} \times 1$

$F_V = 61638,05N$

$x = \frac{4R}{3\pi} = 0,84m$

$F_T = \sqrt{F_H^2 + F_V^2} = 243374,7N$

2nd case:

$F_H = \rho g h_c A = 1000 \times 9,81 \times (2R + R) \times 2R \times$

$F_H = 235,44 \times 10^3\ N$

$y_R = \frac{I_{xc}}{y_c A} + y_c = \frac{1 \times 4^3}{12 \times 6 \times 4} + 6 =$

force verticale:

$F_V = F_2 - (F_A + W)$

$F_A = P_A S_A = \rho g R \times (R \times 1)$ $\bar{h} = \frac{R}{2}$

$F_A = 2 \times 9810 \times 2 \times 2 = 78480N$

$F_2 = P_2 A = \rho g R \times (R \times 1) = 9 \times 9810 \times 2 \times 2$ $\bar{h} = R$

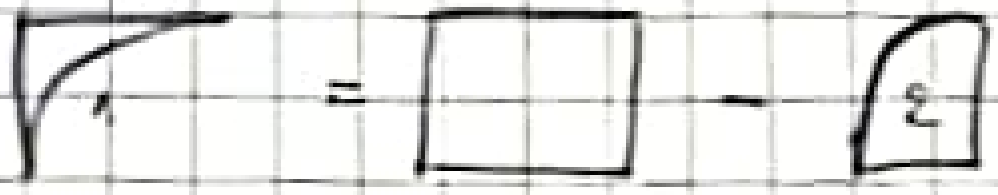
$F_2 = 156960N$

$W = \rho V g = 9810 \times [(R \times 2R \times 1) - \frac{\pi R^2}{2} \times 1]$

$W = 16841,95N$

$F = 156960 - (78480 + 16841,95) = 61638,05$

$$F_T = \sqrt{F_V^2 + F_H^2} = 243374{,}7\,N$$



$$S_A x_A = S_T x - S_2 x_2$$

$$x_A = \frac{S_T x - S_2 x_2}{S_A}$$

$$x_A = \frac{R^2 \cdot \frac{R}{2} - \frac{\pi r^2}{4} \times \frac{4R}{3\pi}}{R^2 - \frac{\pi r^2}{4}}$$

$$x_A = 1{,}55\,m$$