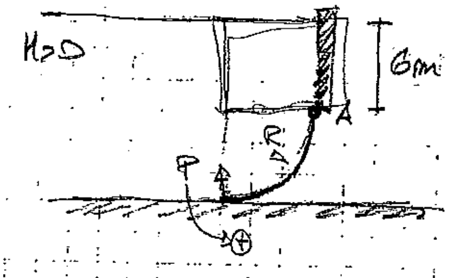
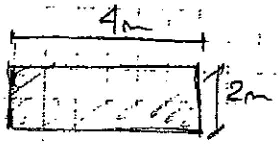
5/6

Matías White - 020701854 PRÁCTICA 4/4

Problema 3) $R = 2m$ Ancho $= 4m$ $\rho_{H_2O} = 1000\ kg/m^3$ $I_{xx} = \frac{bh^3}{12}$



Fuerza Horizontal (Fx)



$F_x = \rho_{H_2O} \cdot g \cdot h_{cg} \cdot Area$

$= \rho_{H_2O} \cdot g \cdot 7m \cdot (4 \times 2) m^2$

$F_x = 548800\ N$ ✓

R+

→ CENTRO DE PRESIÓN de Fx

¿No tiene unidades?

$$y_{cp} = y_{cg} + \frac{I_{xx}}{y_{cg} \cdot Area} = 7 + \frac{8/3\ ?}{7 \cdot (8)\ ?} = \frac{148}{21} = 7{,}05\ m$$

Fuerza Vertical (Fy)

F_y = Peso de la columna de líquido sobre la compuerta $+ (\frac{1}{4}$ sup de círculo$) 4m\ \gamma$

$= \rho_{H_2O} \cdot g \cdot (2m \times 8m \times 4m) + \rho_{H_2O} \cdot g \cdot 4m \left(R^2 - \frac{\pi R^2}{4}\right)$

$= \rho_{H_2O} \cdot g \cdot (64 m^3) - \rho_{H_2O} \cdot g \cdot 4m (0{,}86 m^2)$

$= \rho_{H_2O} \cdot g\ (60{,}57 m^3)$

$F_y = 593550{,}43\ N$

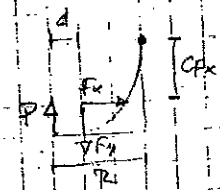
→ CENTRO DE PRESIÓN? de F_y F_y No tiene Centro de presión

$$d = \frac{4}{3}\frac{2m}{\pi} = 0,849 m$$

$$F = \sqrt{F_x^2 + F_y^2} = 808383,29 N$$

$$tg\,\theta = \frac{F_y}{F_x} \Rightarrow \theta = 47,24°$$

$$\Sigma M_A = -P \cdot 2m + F_y \cdot 1,151m + F_x \cdot \frac{22}{21}m = 0$$



$$P = \frac{F_y \cdot 1,151 + F_x \cdot 22/21}{2} = \boxed{629054,93N}$$

Para abrir → se debe aplicar la fuerza $\boxed{P = 629054,93N}$

$P \simeq 55137,78$

MARTÍN FASSETTA TEMA 2 HOJA Nº 1

4 (cuatro)

TEORÍA I

$U = x^2 y \quad V = -x y^2 \quad \vec{v} = (u, v)$

b) Función corriente ψ

$$\frac{\partial V_x}{\partial x} + \frac{\partial V_y}{\partial y} = 0 \qquad \begin{cases} u = V_x = \dfrac{\partial \psi}{\partial y} \\ v = V_y = -\dfrac{\partial \psi}{\partial x} \end{cases}$$

$$x^2 y = \frac{\partial \psi}{\partial y} \Rightarrow x^2 y \, \partial y = \partial \psi$$

Integro ambos lados

$$\Rightarrow \frac{x^2 y^2}{2} + g(x) = \psi(x,y)$$

Derivo con respecto a x:

$$\frac{\partial \psi}{\partial x} = \frac{\cancel{2} x y^2}{\cancel{2}} + g'(x) \quad \text{pero} \quad -\frac{\partial \psi}{\partial x} = -x y^2$$

$$x y^2 = x y^2 + g'(x) \Rightarrow g'(x) = 0$$

Por lo tanto $g(x) = \text{constante} = C$

Finalmente $\boxed{\psi(x,y) = \frac{x^2 y^2}{2} + C}$

a) Ec líneas de campo: $\dfrac{dx}{u} = \dfrac{dy}{v}$

$$\frac{dx}{x^{\cancel{2}} \cancel{y}} = \frac{dy}{-\cancel{x} y^{\cancel{2}}} \Rightarrow -\frac{dx}{x} = \frac{dy}{y} \Rightarrow -\frac{dx}{x} + C = \frac{dy}{y}$$

Integro ambos lados $(-1) \ln |x| + \ln |C| = \ln |y|$

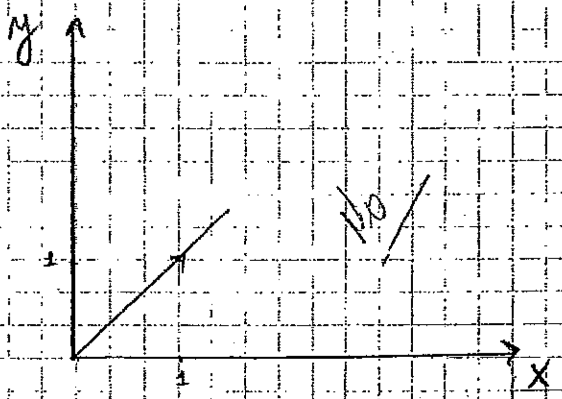
$$\boxed{|x|^{-1} |C| = |y|} \longrightarrow$$

NOTA

$|y| = \frac{|c|}{|x|}$ EN EL $P(1,1)$

$1 = \frac{c}{1} \Rightarrow \boxed{c = 1}$

FINALMENTE $\boxed{y = \frac{1}{x}}$ ✓



NO

c) $Tg\,\alpha = \frac{V_y}{V_x}$ $V = \left(\frac{20y}{x^2+y^2}, \frac{-20x}{x^2+y^2}\right)$

$(5,0) \Rightarrow \alpha = 0°$

$(5,5) \Rightarrow \alpha = 45°$

$(0,5) \Rightarrow \alpha = 0°$

MARTIN FASSETTA

HOJA N 2

FECHA

TEORIA III

$$W = F(V, g, \rho, l, \rho_A)$$

W = FRECUENCIA DE FLUJO $[1/T]$

V = VELOCIDAD VIENTO $[L/T]$

ρ = DENSIDAD AIRE $[M/L^3]$

g = GRAVEDAD $[L/T^2]$

l = LONGITUD SEÑAL $[L]$

ρ_A = DENSIDAD SUPERFICIAL $[M/L^2]$

SIN WALL

$W = Hz = 1/s$

$V = ft/s = 0,3048\ m/s$

$L = ft = 0,3048\ m$

$A\ ft/s^2 = 0,3048\ m/s^2$

W	V	ρ	g	L	ρ_A
$1/T$	L/T	M/L^3	L/T^2	L	M/L^2

$n°\ \Pi: 6-3 = 3$

Π_1: $[L]^a [L/T^2]^b [M/L^3]^c [1/T] = \rho^0 g^0 L^0$

$$\begin{cases} L: & a + b - 3c = 0 \Rightarrow a = 1/2 \\ T: & -2b - 1 = 0 \Rightarrow b = -1/2 \\ M: & c = 0 \end{cases}$$

$\Pi_1 = L^{1/2} g^{-1/2} \rho^0\ W = cte$

$$\Pi_1 = W\sqrt{\frac{L}{g}}$$

Π_2: $[L]^a [L/T^2]^b [M/L^3]^c [L/T] = \rho^0 g^0 L^0$

$$\begin{cases} L: & a + b - 3c + 1 = 0 \Rightarrow a = -1/2 \\ T: & -2b - 1 = 0 \Rightarrow b = -1/2 \\ M: & c = 0 \end{cases}$$

$\Pi_2 = L^{-1/2} g^{-1/2} \rho^0\ V = cte$

$$\Pi_2 = \frac{V}{\sqrt{Lg}} = cte$$

Froude

Π_3: $[L]^a [L/T^2]^b [M/L^3]^c [M/L^2] = \rho^0 g^0 L^0$

$$\begin{cases} L: & a + b - 3c - 2 = 0 \Rightarrow a = -1 \\ T: & -2b = 0 \Rightarrow b = 0 \\ M: & c + 1 = 0 \Rightarrow c = -1 \end{cases}$$

$\Pi_3 = L^{-1} g^0 \rho^{-1} \rho_A = cte$

$$\Pi_3 = \frac{L \rho_A}{\rho} = cte$$

NOTA

3

$\Pi_1 = F(\Pi_2, \Pi_3)$

	Modelo	Prototipo
	$L = 4\,ft$	$L = 40\,ft$
	Tunel viento	$V = 30\,ft/s$

$$W\sqrt{\frac{L}{g}} = F\left(\frac{V}{\sqrt{Lg}}, \frac{L\rho_A}{\rho}\right)$$

$$W = \sqrt{\frac{g}{L}}\; F\left(\frac{V}{\sqrt{Lg}}, \frac{L\rho_A}{\rho}\right)$$

$l = 40\,ft$

Se desea predecir W para $L = 40\,ft$, $V = 30\,ft/s$, con un modelo con $l = 4\,ft$

a) Π_3 modelo $= \Pi_3$ prototipo $\quad \rho_{A_p} = 0{,}006\ slugs/ft^3 \quad L_m = 40\,ft \quad l_p = 4\,ft$

$\Pi_3 = \dfrac{L\rho_A}{\rho}$ Por lo tanto $\dfrac{L_m\, \rho_{A.m}}{\cancel{\rho}} = \dfrac{L_p\, \rho_{A.p}}{\cancel{\rho}}$

$$\rho_{A\,m} = \frac{40\,ft \cdot 0{,}006\,slugs/ft^3}{4\,ft}$$

$$\boxed{\rho_{A\,m} = 0{,}06\ \frac{slugs}{ft^3}}$$

b) Velocidad en el tunel de viento para testear el modelo.

Π_2 modelo $= \Pi_2$ prototipo $\quad V_{modelo} = 30\,ft/s$

$\Pi_2 = \dfrac{V}{\sqrt{Lg}}$ Por lo tanto $\dfrac{V_m}{\sqrt{L_m g}} = \dfrac{V_p}{\sqrt{L_p g}}$

$0{,}3048\ m/s^2 \longrightarrow 1\ ft/s^2$

$9{,}8\ m/s^2 \longrightarrow x = 32{,}15\ ft/s^2$

$$V_m = \frac{V_p\sqrt{L_m g}}{\sqrt{L_p g}} \qquad \boxed{V_m = 9{,}49\ ft/s}$$

c) $W_m = 6\,Hz \qquad \Pi_{1\,m} = \Pi_{1\,p}$

$\Pi_1 = W\sqrt{\dfrac{L}{g}}$ Por lo tanto $W_m\sqrt{\dfrac{L_m}{g}} = W_p\sqrt{\dfrac{L_p}{g}}$

$$W_p = W_m\sqrt{\frac{L_m}{g}}\cdot\sqrt{\frac{g}{L_p}}$$

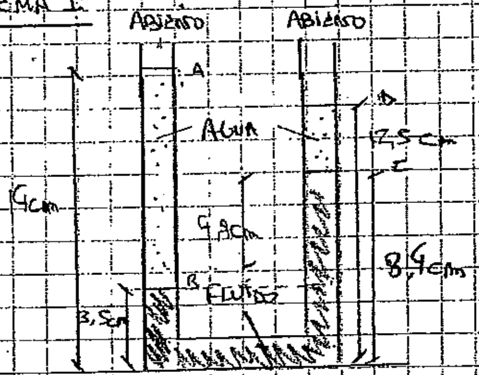
$$\boxed{W_p = 1{,}9\ Hz}$$

MARTIN FASSETTA

HOJA N° 3

FECHA

PROBLEMA I



$\rho_{AGUA} = 1000\ kg/m^3$

$P_{ATM} = 101,3\ kPa$

$Pa = \frac{N}{m^2}$

$P_A = P_{ATM} = 101,3\ kPa$

$P_B = P_A + \rho g \Delta H = 101,3\ kPa + 1000 \frac{kg}{m^3} \cdot 9,8 \frac{m}{s^2} (0,14 - 0,035)\ m$

$P_B = 101,3\ kPa + 1029\ Pa$

$\underline{P_B = 102329\ Pa}$

$P_D = 101,3\ kPa$

$P_C = P_D + \rho g \Delta H = 101,3\ kPa + 1000 \frac{kg}{m^3} \cdot 9,8 \frac{m}{s^2} (0,125 - 0,084)\ m$

$P_C = 101,3\ kPa + 401,8\ Pa$

$\underline{P_C = 101701,8\ Pa}$

Luego:

$P_B = P_C + \rho_F g \Delta h$

$P_B - P_C = \rho_F g \Delta h \Rightarrow \rho_F = \frac{(P_B - P_C)}{g \Delta h}$

$Pa = \frac{N}{m^2} = \frac{\frac{kg\, m}{s^2}}{m^2} = \frac{kg}{s^2 m}$

$\frac{\frac{kg}{s^2 m}}{\frac{m^2}{s^2}} = \frac{kg}{m^3}$

$\rho_F = \frac{(102329\ Pa - 101701,8\ Pa)}{9,8 \frac{m}{s^2} \cdot 0,049\ m} = \frac{627,2\ Pa}{0,48 \frac{m^2}{s^2}} = 1306,12 \frac{kg}{m^3}$

$\boxed{\rho_F = 1306,12\ kg/m^3}$

NOTA

$\rho = \frac{m}{V} \Rightarrow m = \rho V$

PESO: $W = mg$

LUEGO: $W = \rho V g = 1306{,}12 \frac{kg}{m^3} \cdot 9{,}8 \frac{m}{s^2}$

$$\boxed{W_e = 12800 \frac{N}{m^3} = 12{,}8 \frac{kN}{m^3}}$$

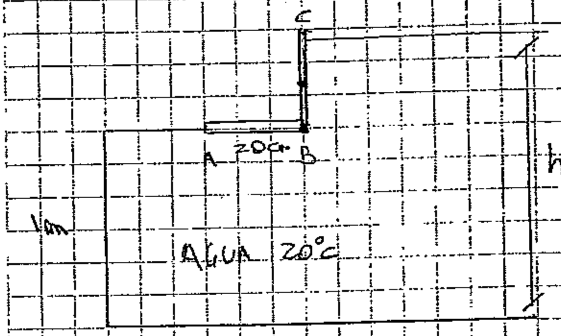
EL PESO ESPECÍFICO DEL FLUIDO DESCONOCIDO ES: $\boxed{12800 \, N/m^3}$

MARTÍN FASSETTA

HOJA N° 4

FECHA

PROBLEMA III



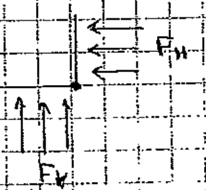
DATOS:

ANCHO: 2m

$\rho_{AGUA} = 1000\ kg/m^3$

$\overline{AB} = 20cm = 0{,}2m$

$\overline{CB} = h - 1m$



CENTRO $\frac{L}{2}$ $\quad I_{xx} = \frac{bL^3}{12}$ $\quad$ AREA $b \cdot L$ $\quad \gamma = g\rho$

$$F_H \begin{cases} F_H = \gamma \cdot H_{cg} \cdot A \\ y_{cp} = y_{cg} + \frac{I_{xx}}{y_{cg} A} \end{cases}$$

F_V = PESO DEL AGUA DESPLAZADA QUE PASA POR EL C_g

PARA QUE SE HABRA LA COMPUERTA $F_H > F_V$ ✓

PIVOTEA

- $F_V = m_{H_2O}\, g = g\, VOL\, \rho$

VOL =  · ANCHO = $\frac{\pi R^2}{4} \cdot b$

$F_V = 9{,}8\ \frac{m}{s^2}\ 0{,}063\ \cancel{m^3}\ 1000\ kg/\cancel{m^3}$

VOL = $0{,}063\ m^3$

$F_V = 615{,}7\ N$

- $I_{xx} = \frac{\cancel{2}m \cdot (h - 1m)^3}{\cancel{12}} = \frac{(h-1m)^3\, m}{6}$

$$y_{cp} = y_{cg} + \frac{I_{xx}}{y_{cg}\, A} = \frac{(h-1m)}{2} + \frac{\frac{(h-1m)^{\cancel{3}}\ \cancel{m}}{6}}{\cancel{\frac{(h-1m)}{2}}\ \cancel{2m\,(h-1m)}}$$

$$y_{cp} = \frac{(h-1m)}{2} + \frac{(h-1m)}{6} = \frac{(h-1m)\,2}{3}$$

NOTA

$$F_H = \gamma \cdot h_{cg} \cdot A = \rho_{H_2O}\, g \,\frac{(h-1m)2}{3} \cdot ((h-1m) \cdot 2m)$$

$$F_H = 1000 \frac{kg}{m^3} \cdot 9{,}8 \frac{m}{s^2} (h-1m) \frac{2}{3} (h-1m)\, 2m$$

$$F_H = 13066{,}67 \frac{kg}{ms^2} (h-1m)^2$$

LUEGO IGUALO

$$F_H = F_V$$

$$615{,}7 N = 13.066{,}67 \frac{kg}{ms^2} (h-1m)^2$$

$$\frac{\frac{kg\, m}{s^2}}{\frac{kg}{ms^2}} = m^2$$

$$\sqrt{\frac{615{,}7 N}{13066{,}67 \frac{kg}{ms^2}}} = (h-1m)$$

$$\Rightarrow 0{,}217 m = h - 1m$$

$$\boxed{h = 1{,}217 m}$$ 1,346 m R

∴ LA COMPUERTA SE ABRIRÁ A PARTIR DE h = 1,217 m