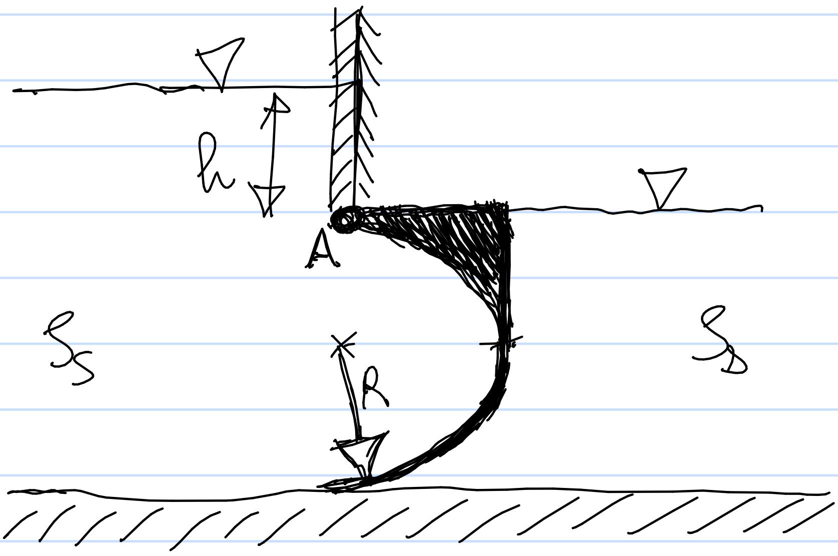
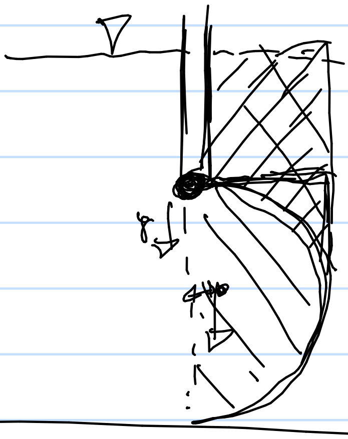


$$F_{OS} = \rho_S g (h+R) 2Rb \quad \text{(VERSO DESTRA)}$$

$$F_{VS} = \rho_S g \frac{\pi R^2}{2} b \quad \text{(VERSO IL BASSO)}$$



METTENDO LA FORZA RISULTANTE NEL CENTRO DELLA CIRCONFERENZA

$$M_O = \rho_S g (h+R) 2R^2 b$$

OPPURE

$$F_{OS} = \int_0^{2R} \rho g (h+y)\, b\, dy$$

$$= \rho g b \left[hy + \frac{y^2}{2} \right]_0^{2R}$$

$$= \rho g b \left(h2R + \frac{4R^2}{2} \right)$$

$$= \rho g b (h+R) 2Rb$$

$$M_{OS} = \int_0^{2R} \rho g (h+y)\, y\, b\, dy$$

$$= \rho g b \left[h\frac{y^2}{2} + \frac{y^3}{3} \right]_0^{2R}$$

$$= \rho g b \left(h\frac{4R^2}{2} + \frac{8R^3}{3} \right)$$

$$= \rho g b 2R^2 \left(h + \frac{4R}{3} \right)$$

$$M_{or} = -\rho g \frac{\cancel{\pi} R^2}{2} b \, \frac{4}{3} \frac{R}{\cancel{\pi}}$$

$$= -\rho g \frac{2}{3} R^3 b$$

$$M_o = M_{os} + M_{or} = \rho g b \, 2R^2 \left(h + \frac{4}{3} R - \frac{1}{3} R \right)$$

$$= \rho_s g b \, 2R^2 \left(h + R \right)$$

$$F_{oD} = \rho_D g R (2Rb) = \rho g \, 2R^2 b$$ (VERSO SINISTRA)

$$F_{vD} = \rho_D g b \left(R^2 + \frac{\pi R^2}{4} \right)$$ (VERSO L'ALTO)

$$M_{oD} = -\rho_D g \, 2R^2 b \, \frac{2}{3} 2R = -\frac{8}{3} \rho_D g R^3 b$$

$$M_{vD} = \rho_D g b \left(R^2 \frac{R}{2} + \frac{\cancel{\pi} R^2}{\cancel{4}} \frac{\cancel{4}}{3} \frac{R}{\cancel{\pi}} \right)$$

$$M_D = \rho_D g b \left(\frac{R^3}{2} + \frac{R^3}{3} - \frac{8}{3} R^3 \right)$$

$$= \rho_D g b \left(\frac{R^3}{2} - \frac{7}{3} R^3 \right)$$

$$= \rho_D g b \left(\frac{3R^3 - 14 R^3}{6} \right) = -\rho_D g b \, \frac{11}{6} R^3$$

OPPURE (SPEZZANDO IN DUE )

$$F^1_{OD} = \rho g \frac{R}{2} R b$$

$$M^1_{OD} = \rho g \frac{R}{2} R b \frac{2}{3} R = -\rho g \frac{R^3}{3} b$$

$$M_{VD} = 0$$

$$F^2_{OD} = \rho g \left(R + \frac{R}{2}\right) R b$$

$$M^2_{OD} = \rho g \left(\frac{3}{2} R\right) R b R = -\rho g \frac{3}{2} R^3 b$$

$$M_D = -\rho g b R^3 \left(\frac{3}{2} + \frac{1}{3}\right) = -\rho g b R^3 \left(\frac{9+2}{6}\right)$$

$$= -\rho g \cancel{b} R^3 \left(\frac{11}{6}\right)$$

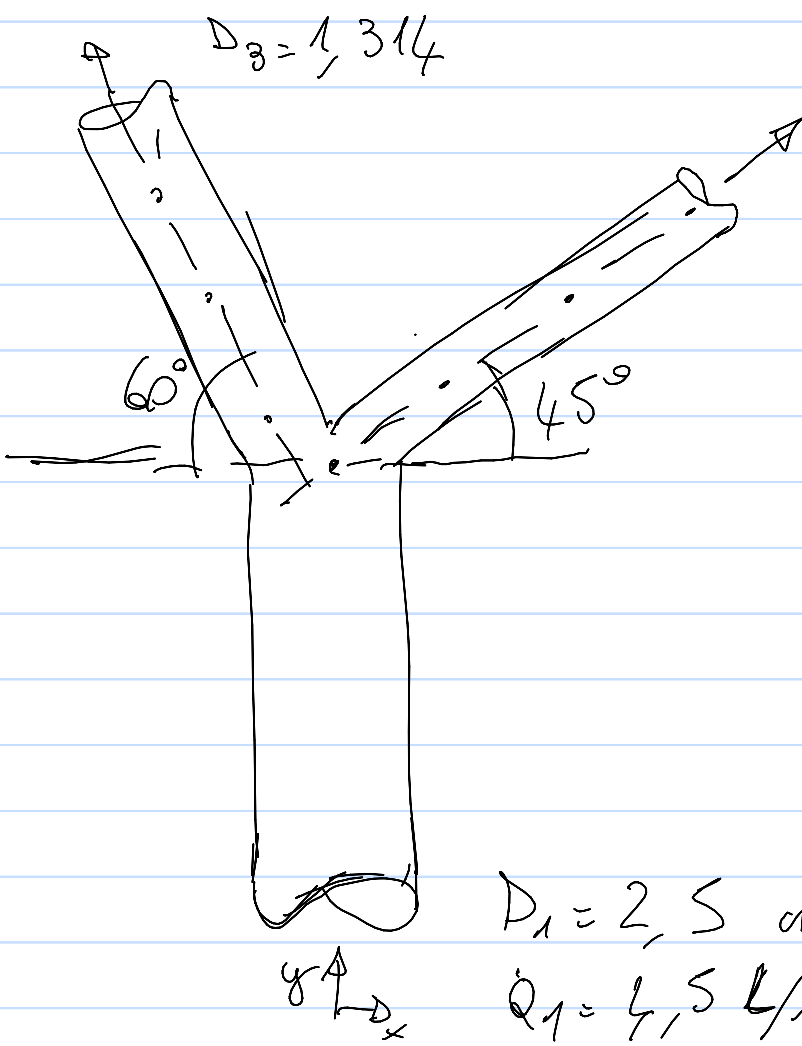
$$M_S + M_D = 0$$

$$\rho_S \cancel{g} \cancel{b} (h+R) 2 \cancel{R^2} \cancel{b} - \rho_D \cancel{g} \cancel{b} \cancel{R^3} \frac{11}{6} = 0$$

$$\frac{\rho_S}{\rho_D} = \frac{11}{12} \frac{R}{h+R}$$

6,71 PG 285

$\rho = 1{,}060 \ g/cm^3$



$D_1 = 2{,}5 \ cm$

$\dot{Q}_1 = 4{,}5 \ L/min$

$P_1 = 140 mmHg = 18665 \dfrac{g}{cm\,s^2}$

CONS MASSA

$$\rho U_1 A_1 = \rho U_2 A_2 + \rho U_3 A_3$$

$$\dot{Q}_1 = \dot{Q}_2 + \dot{Q}_3 \qquad Q_3 = 2{,}5 \ L/min$$

$$U_1 = \frac{Q_1}{A_1} = \frac{Q_1}{\frac{\pi D_1^2}{4}} = \frac{4500 \ cm^3/min \cdot 4 \cdot \frac{1 \ min}{60 \ sec}}{\pi \ 2{,}5^2 \ cm^2}$$

$$= 15{,}28 \ cm/s$$

$U_2 = 27{,}16 \ cm/s$

$U_3 = 30{,}72 \ cm/s$

CONS QDM y

$$\int_{A_1} \rho \vec{U}_1 \cdot \vec{j}\ \vec{U}_1 \cdot \vec{n}\, dA + \int_{A_2} \rho \vec{U}_2 \cdot \vec{j}\ \vec{U}_2 \cdot \vec{n}\, dA + \int_{A_3} \rho \vec{U}_3 \cdot \vec{j}\ \vec{U} \cdot \vec{n}\, dS$$

$$= -\int_{A_1} P_1\, \vec{n} \cdot \vec{j}\, dA - \int_{A_2} P_2\, \vec{n} \cdot \vec{j}\, dA - \int_{A_3} P_3\, \vec{n} \cdot \vec{j}\, dA + F_y$$

$$\rho U_1 (-U_1) A_1 + \rho U_2 \cos 45\ U_2 A_2 + \rho U_3 \cos 30^\circ\ U_3 A_3$$

$$= + P_1 A_1 - P_2 A_2 \cos 45 - P_3 \cos 30^\circ A_3 + F_y$$

$$-\rho U_1^2 A_1 + \rho U_2^2 A_2 \cos 45^\circ + \rho U_3^2 A_3 \cos 30^\circ$$

$$- P_1 A_1 + P_2 A_2 \cos 45 + P_3 A_3 \cos 30^\circ = F_y$$

$$\frac{U_1^2}{2} + \cancel{g} z_1 + \frac{P_1}{\rho} = \frac{U_2^2}{2} + \cancel{g} z_2 + \frac{P_2}{\rho}$$

$$P_2 = P_1 + \frac{\rho}{2}\left(U_1^2 - U_2^2\right)$$

$$= 186651 \frac{g}{cm\, s^2} - 267{,}22\ g/cm\, s^2$$

$$= 186383{,}8\ g/cm\, s^2$$

$$P_3 = P_1 + \frac{\rho}{2}\left(U_1^2 - U_3^2\right) = 186274{,}6\ g/cm\, s^2$$

$$F_y = -535089 \frac{g\,cm}{s^2}$$

LA FORZA ESERCITATA DAL FLUIDO SULLA BIFORCAZIONE HA SEGNO OPPOSTO (VERSO L'ALTO)

$$535089 \frac{g\,cm}{s^2} \simeq 5 \frac{kg\,m}{s^2}$$

VALVOLA A SARACINESCA

$$\Delta P = f(h, d, V, \rho, \mu)$$

$$[\Delta P] = \frac{N}{m^2} = \frac{kg\, m}{s^2\, m^2} = \frac{kg}{m\, s^2}$$

$$[h, d] = m$$

$$[V] = m/s$$

$$[\rho] = kg/m^3$$

$$[\mu] = [\rho V d] = kg/m^3 \; m/s \; m = \frac{kg}{m\, s}$$

6 VAR
3 DIM $\Rightarrow$ 3 GRUPPI

VAR RIPETUTE V, ρ, d

COMBINANDO 1) $\rho, V, d, \Delta P \Rightarrow \frac{\Delta P}{\rho V^2} = Eu$

2) $\rho, V, d, \mu \Rightarrow \frac{\rho V d}{\mu} = Re$

3) $\rho, V, d, h \Rightarrow \frac{h}{d}$

$$h_m = \frac{1}{5} h_p$$

$$d_m = \frac{1}{5} d_p$$

$$\frac{h_m}{d_m} = \frac{h_p}{d_p}$$ (SIMILITUDINE GEOMETRICA)

V_m QUANDO $V_p = 3\,m/s$

$$Re_m = Re_p$$

$$\frac{\rho_m V_m d_m}{\mu_m} = \frac{\rho_p V_p d_p}{\mu_p}$$

$$V_m = \frac{\rho_p}{\rho_m} \frac{d_p}{d_m} \frac{\mu_m}{\mu_p} V_p$$

$$= \frac{800}{1000}\, 5\, \frac{0{,}001}{0{,}002} V_p$$

$$= \frac{\cancel{4}^{2}}{\cancel{5}} \cancel{5} \frac{1}{\cancel{2}} V_p = 6\,m/s$$

DOMANDA TEORICA

$u = x^2 - y^2 + x$

$v = -2\cancel{x}y - y$

$\nabla \cdot \vec{v} = 2x + 1 - 2x - 1 = 0$

ACCELERAZIONE PUNTO $(2,1)$

$$a = \frac{Dv}{Dt} = \cancel{\frac{\partial \vec{v}}{\partial t}} + \vec{v} \cdot \nabla \vec{v}$$

$$\nabla v = \begin{bmatrix} 2x+1 & -2y \\ -2y & -2x-1 \end{bmatrix}$$

$$\vec{v} \cdot \nabla \vec{v} = \begin{bmatrix} (x^2-y^2+x)(2x+1) + (-2xy-y)(-2y) \\ (x^2-y^2+x)(-2y) + (-2xy-y)(-2x-1) \end{bmatrix}$$

IN $(2,1)$ $a = 35\vec{i} + 15\vec{j}$

$$\vec{\vec{\tau}} = \mu \left(\nabla \vec{v} + \nabla \vec{v}^T\right)$$

$\mu = 1$

$$\vec{\vec{\tau}} = 2 \begin{bmatrix} 2x+1 & -2y \\ -2y & -2x-1 \end{bmatrix}$$

SFORZO SUPERFICIE NORMALE $\vec{j}$

$$\vec{\tau} = \vec{\vec{\tau}} \cdot \vec{n} = \vec{\vec{\tau}} \cdot \vec{j} = \begin{bmatrix} -4y, & -4x-2 \end{bmatrix}$$