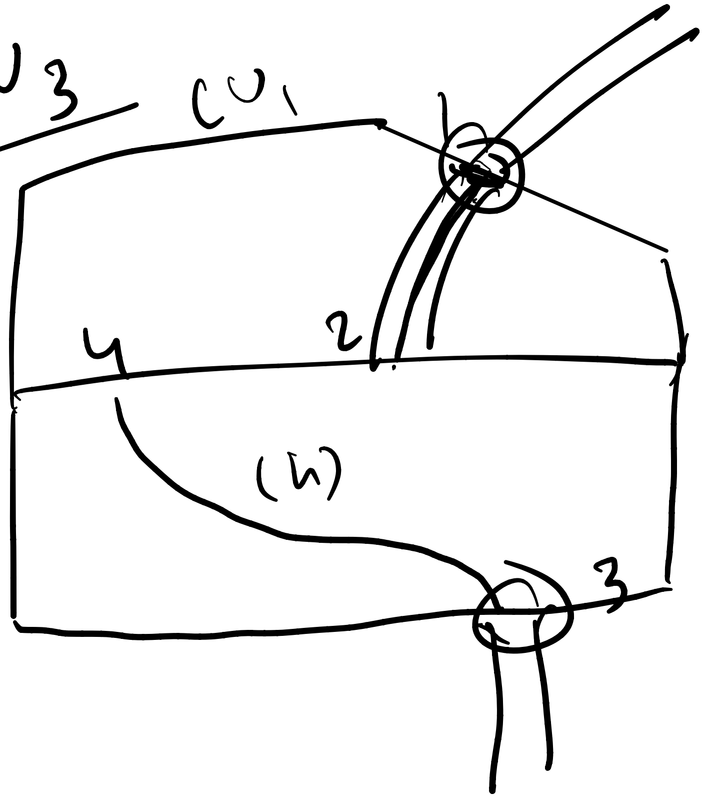
v_3



$$\rho A_3 v_3 = \rho A_1 v_1$$

$$v_3 = v_1 \left(\frac{A_1}{A_3} \right)$$

h

$$\frac{1}{2}\rho v_3^2 = \frac{1}{2}\rho \cancel{v_4^2} + \rho g h$$

$$h = \frac{v_3^2}{2g}$$

v_2

$$\frac{1}{2}\rho v_1^2 + \rho g H = \frac{1}{2}\rho v_2^2 + \rho g h$$

$$v_2 = \sqrt{2g(H-h) + v_1^2}$$

Made with Goodnotes

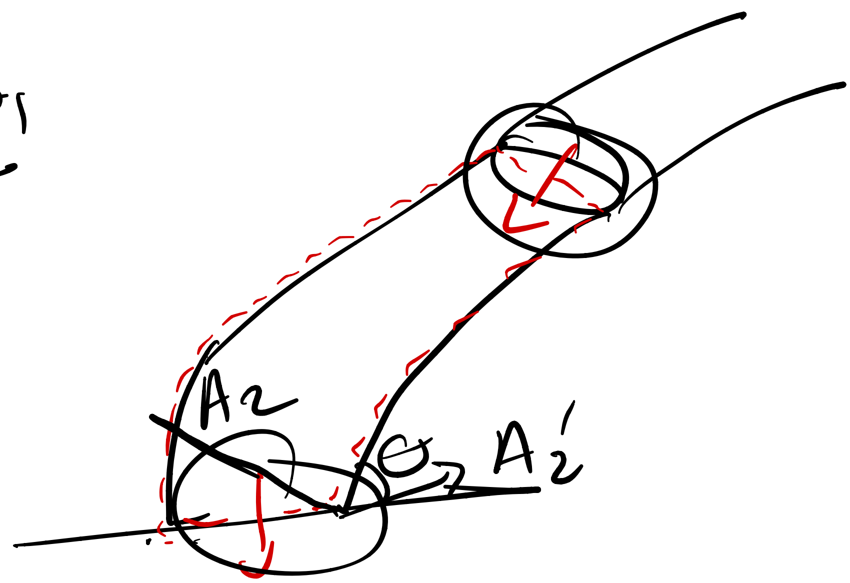
θ_2

$v_{1x} = v_{2x}$

$v_{1x} = v_1 \cos\theta_1 \quad v_{2x} = v_2 \cos\theta_2$

$v_1 \cos\theta_1 = v_2 \cos\theta_2$

$\cos\theta_2 = \frac{v_1 \cos\theta_1}{v_2}$



A_2

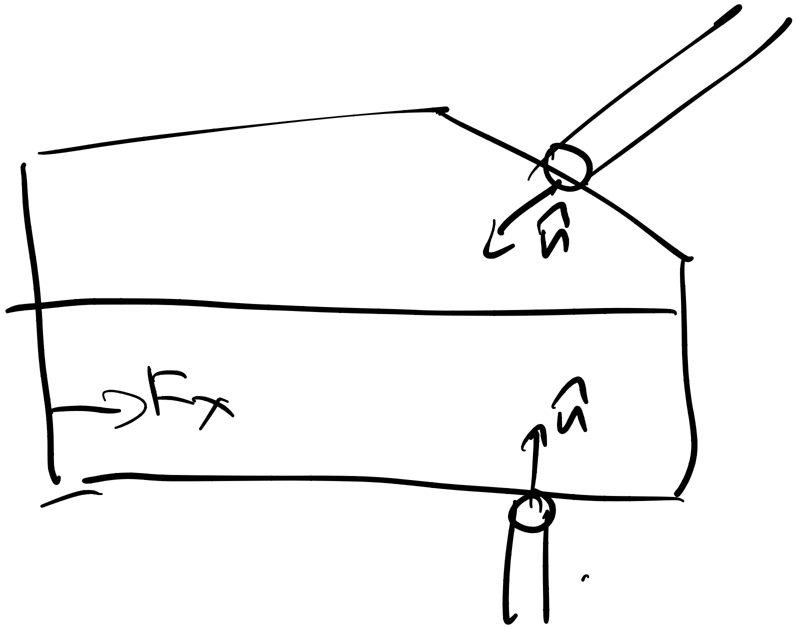
$A_2 = A_2' \sin\theta$

$(v \cdot n)$

$A_1 v_1 = A_2' v_2 \sin\theta$

$A_1 v_1 = A_2 v_2 \quad A_2 = A_1 \left(\frac{v_1}{v_2}\right)$

Made with Goodnotes



$$\dot{M}_x = 0 = F_x + \underline{\rho A_1}\,\underline{(n_1 \cdot v_1)}^{v_1}(\hat{x} \cdot v_1) +$$

$$\cancel{\rho A_3 (n_3 \cdot v_3)(\hat{x} \cdot v_3)}$$

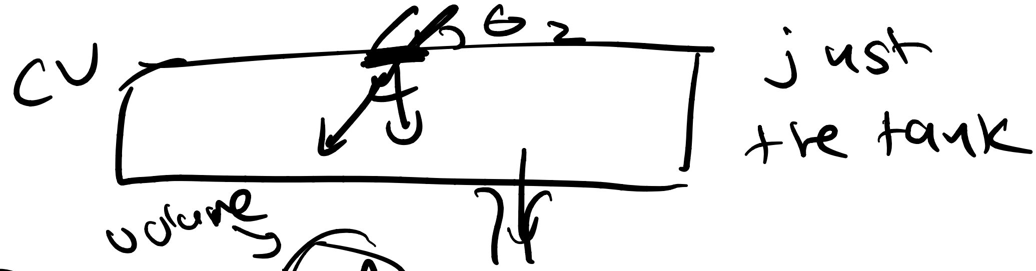
$-v_3$ $\quad 0$

$$\hat{x} \cdot v_1 = -v \cos\theta_1 \qquad 0 = F_x + \rho A_1 v_1 (-v_1 \cos\theta_1)$$

$$F_x = \rho A v_1^2 \cos\theta_1$$

Made with Goodnotes

F_2



$$\dot{M}_2 = 0 = F_2 - \rho g \underbrace{hA}_{\text{volume}}$$

$$+ \rho A_2' (\hat{n} \cdot V_2)(\hat{i} \cdot V_2) + \rho A_3 \underbrace{(\hat{n}_3 \cdot V_3)}_{-V_3} \underbrace{(\hat{i} \cdot V_3)}_{-V_3}$$

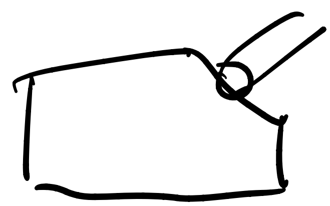
$$\hat{n} \cdot V_2 = V_2 \sin\theta_2$$

$$\hat{i} \cdot V_2 = -V_2 \sin\theta_2$$

$$F_2 = \rho g h A + \rho A_2 V_2^2 \sin\theta_2 - \rho A_3 V_3^2$$

$$(\rho A_2' V_2^2 \sin^2\theta_2)$$

b) (Large CV)



$$\dot{M}_2 = F_2 - \rho g h A - W_{jet}$$

$$+ \rho A_1 \underbrace{(n_1 \cdot V_1)}_{V_1} \underbrace{(\hat{i} \cdot V_1)}_{-V_1 \sin\theta} + \rho A_3 (\hat{n}_3 \cdot V_3)(\hat{i} \cdot V_3)$$

$$W_{jet} = F_2 - \rho g h A - \rho A_1 V_1^2 \sin\theta + \rho A_3 V_3^2$$

$$\frac{W_{jet}}{g} = M_{jet}$$

Made with Goodnotes