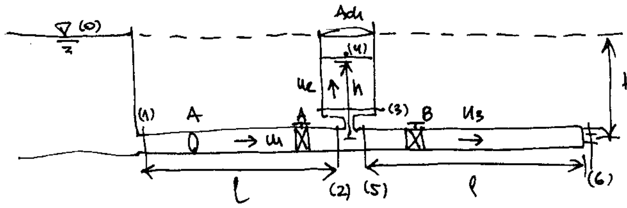


Cálculo de Bernoulli [redacted] 1.0

$$B_0 = B_1 = H_0 \; ; \quad \frac{L}{g}\frac{\partial u_1}{\partial t} + B_2 - B_1 + \Lambda_A \cdot \text{signo}(u_1) = 0 \quad \text{Euler}_{1-2}$$

$$B_2 = B_3 = B_5 \; ; \quad \frac{h}{g}\frac{\partial u_2}{\partial t} + B_4 - B_3 = 0 \quad \text{Euler } 3\text{-}4$$

$$\frac{l}{g}\frac{\partial u_3}{\partial t} + B_6 - B_5 + \Lambda_B \cdot \text{signo}(u_3) = 0 \quad \text{Euler } 5\text{-}6$$

[redacted] 1.0

$$B_6 = \underbrace{\cancel{\frac{P_{atm}}{\gamma}}}_{0} + \underbrace{\cancel{\frac{u_3^2}{2g}}}_{\approx 0} = 0 \; ; \quad B_4 = \underbrace{\cancel{\frac{P_{atm}}{\gamma}}}_{0} + h + \underbrace{\cancel{\frac{u_2^2}{2g}}}_{\approx 0} = h$$

Conservación de Volumen [redacted] 0.5

$$u_1 A = u_2 A_{ch} + u_3 A \rightarrow \frac{\partial u_1}{\partial t} - \frac{\partial u_3}{\partial t} = \frac{A_{ch}}{A}\frac{\partial u_2}{\partial t}$$

$$\underbrace{u_2}_{\text{Vel. chimenea}} = \frac{dh}{dt} \rightarrow \frac{\partial u_1}{\partial t} - \frac{\partial u_3}{\partial t} = \frac{A_{ch}}{A}\frac{d^2h}{dt^2}$$

0.5

$$\Rightarrow \left.\begin{aligned} &\frac{L}{g}\frac{\partial u_1}{\partial t} + B_2 - H_0 + \frac{u_1}{|u_1|}\Lambda_A = 0 \\ &\frac{l}{g}\frac{\partial u_3}{\partial t} - B_2 + \frac{u_3}{|u_3|}\Lambda_B = 0 \\ &\frac{h}{g}\frac{d^2h}{dt^2} + h - B_2 = 0 \end{aligned}\right\} \begin{aligned} &\frac{L}{g}\frac{\partial u_1}{\partial t} + \frac{h}{g}\frac{d^2h}{dt^2} + h - H_0 + \frac{u_1}{|u_1|}\Lambda_A = \\ &\frac{L}{g}\left(\frac{\partial u_1}{\partial t} + \frac{\partial u_3}{\partial t}\right) - H_0 + \frac{u_1}{|u_1|}\Lambda_A + \frac{u_3}{|u_3|}\Lambda_B = \\ &\frac{\partial u_1}{\partial t} - \frac{\partial u_3}{\partial t} = \frac{A_{ch}}{A}\frac{d^2h}{dt^2} \end{aligned}$$

$$\Rightarrow \frac{L}{g}\underbrace{\left(\frac{\partial u_1}{\partial t} - \frac{\partial u_3}{\partial t}\right)}_{\frac{A_{ch}}{A}\frac{d^2h}{dt^2}} + \frac{2h}{g}\frac{d^2h}{dt^2} + 2h - 2H_0 + 2\frac{u_1}{|u_1|}\Lambda_A + H_0 - \frac{u_1}{|u_1|}\Lambda_A - \frac{u_3}{|u_3|}\Lambda_B = 0$$

$$\boxed{\left(\frac{2h}{g} + \frac{L}{g}\frac{A_{ch}}{A}\right)\frac{d^2h}{dt^2} + 2h - H_0 + \frac{u_1}{|u_1|}\Lambda_A - \frac{u_3}{|u_3|}\Lambda_B = 0}$$ [redacted]

$$\frac{l\,A_{ch}}{A} >> 2h \quad \Rightarrow \quad \frac{l}{g}\frac{A_{ch}}{A}\,\ddot{h} + 2h = H_0 + \frac{u_3}{|u_3|}\lambda_B - \frac{u_1}{|u_1|}\lambda_A$$

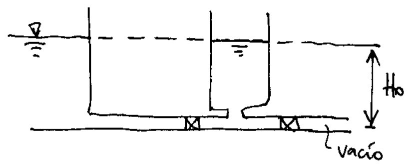
sea $k = \frac{2gA}{l\,A_{ch}}$ $\Rightarrow$ 0,5 $\boxed{\ddot{h} + kh = \frac{k}{2}H_0 + \frac{k}{2}\left(\frac{u_3}{|u_3|}\lambda_B - \frac{u_1}{|u_1|}\lambda_A\right)}$

$1.0 + 1.0 + 0,5 + 0,5 + 0,5 = 3,5$

→ condición inicial:

$u_1 = u_3 = 0$

$h = H_0$



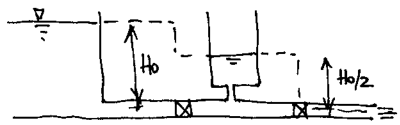
0,3

→ Rég. permanente final:

$$\frac{dh}{dt} = 0 \quad \Rightarrow \quad kh = \frac{k}{2}H_0 + k\left(\frac{u_3}{|u_3|}\lambda_B - \frac{u_1}{|u_1|}\lambda_A\right)$$

0,3

y $u_3 = u_1 > 0;\ \lambda_A = \lambda_B \quad \Rightarrow \quad h = \frac{H_0}{2}$



Y $H_0 = \lambda_A + \lambda_B$

$\Rightarrow H_0 = 2\lambda_A$

$\lambda_A = \frac{H_0}{2}$

$\lambda_A = k_v \frac{u_1^2}{2g} = \frac{H_0}{2} \quad \Rightarrow \quad u_1 = \sqrt{\frac{gH_0}{k_v}} = u_3$

$Q = A\sqrt{\frac{gH_0}{k_v}}$

→ suponiendo $u_1, u_3 > 0$ $\Rightarrow$ $\lambda_A = \lambda_B$ (no muy buena aproximación)

1,5

$$\left.\begin{array}{l} \ddot{h} + kh = \frac{k}{2}H_0 \\ h(0) = H_0 \\ \dot{h}(0) = 0 \end{array}\right\} \quad h(t) = \frac{H_0}{2}\left\{1 + \cos(\sqrt{k}\,t)\right\}$$