LE ONDE ACUSTICHE

ESERCIZI & RIPASSO

Es.:

$v_0 = 310\ m/s$

$f_n = 375\ Hz$

$f_{n+1} = 450\ Hz$

$L = ?$

$f_1 = ?$

MODI NORMALI DI OSCILL.
(ONDE STAZIONARIE)

$$L = n \cdot \frac{\lambda_n}{2} \qquad \lambda_n = \frac{2L}{n}$$

$$\forall n : \quad f_n \cdot \lambda_n = v_0$$

$$f_n = \frac{v_0}{\lambda_n}$$

$$= \frac{v_0}{\frac{2L}{n}}$$

$$= n \cdot \frac{v_0}{2L}$$

$$f_n \qquad f_{n+1}$$

$$f_{n+1} - f_n = (n+1)\frac{v_0}{2L} - n \cdot \frac{v_0}{2L}$$

$$= n\frac{v_0}{2L} + \frac{v_0}{2L} - n\frac{v_0}{2L}$$

$$f_{n+1} - f_n = \frac{v_0}{2L}$$

$$L = \frac{v_0}{2(f_{n+1} - f_n)}$$

$$L = \frac{310\ m/s}{2\,(450\ Hz - 375\ Hz)} = 2.0\bar{6}\ m$$

$$f_1 = 1 \cdot \frac{v_0}{2L}$$

$$= \frac{310\ m/s}{2 \cdot 2.06\ m} = 75.0\ Hz.$$

Es.: $L = 1.0\ m$

$f_1 = 256\ Hz$

$L' = 0.4\ m$ $\quad f_1' = ?$

$v_0 = f_1 \cdot \lambda_1$ $\quad \lambda_1 = 2\ m$

$$\ell = \lambda/2$$

$$v_0 = f_1 \cdot \lambda_1 = 256\,Hz \cdot 2\,m$$

$$\hat{=} 512\,m/s$$

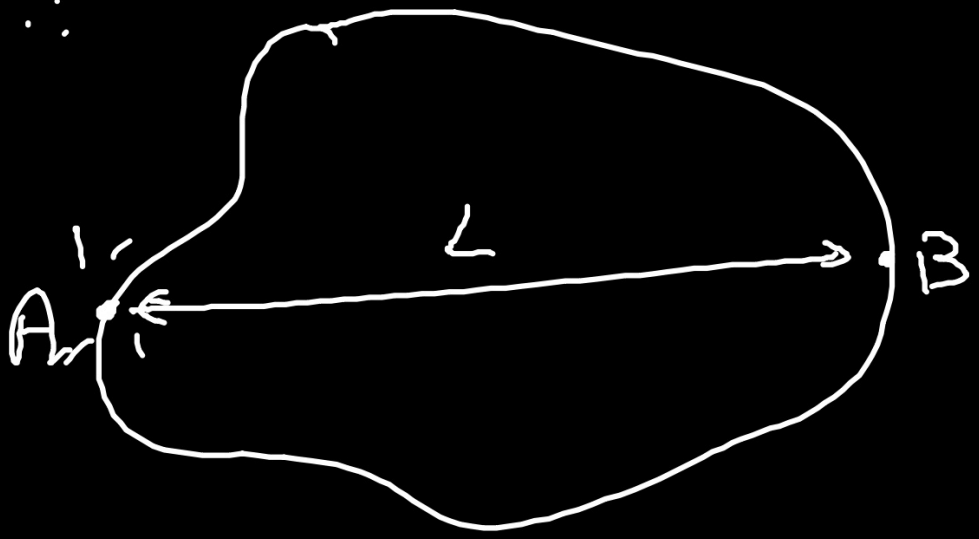
$$L' = 0.4\ m$$

$$v_0 = f_1' \cdot \lambda_1'$$

$$\lambda_1' = 2 \cdot L' = 0.8\ m$$

$$f_1' = \frac{v_0}{\lambda_1'} = 640\ Hz$$

Es.:



$\Delta t = 12\,s$ $\quad v_w = 1.5 \cdot 10^3\,m/s$

$L = ?$ $\quad v_a = 340\,m/s$

$$t_a = \frac{L}{v_a}$$

$$> \quad t_w = \frac{L}{v_w}$$

$$\Delta t = t_a - t_w = \frac{L}{v_a} - \frac{L}{v_w}$$

$$\Delta t = L \cdot \left(\frac{1}{v_2} - \frac{1}{v_w} \right)$$

$$L = \frac{\Delta t}{\frac{1}{v_2} - \frac{1}{v_w}}$$

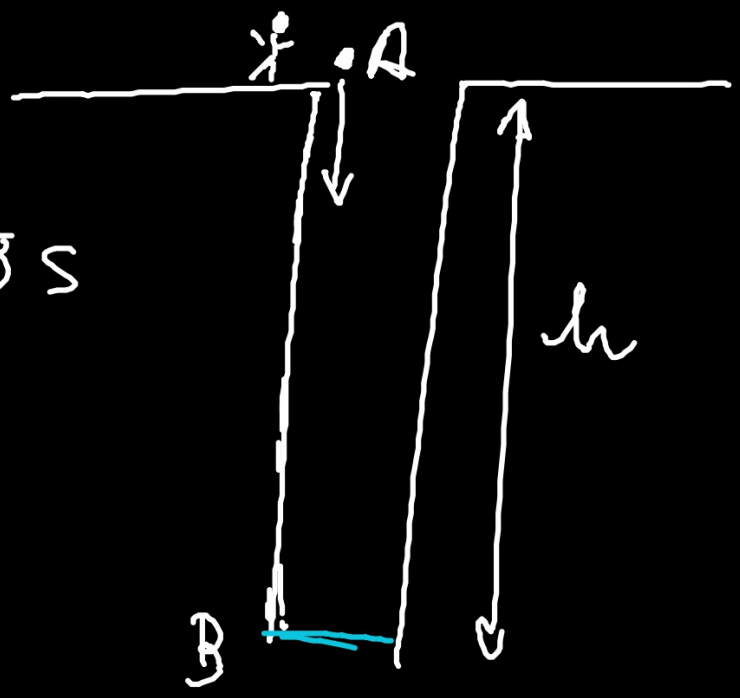
$$= \frac{12\,s}{1/340\,m/s - 1/1.5 \cdot 10^3\,m/s} \approx 5.3\,km$$

$$= 5275\,m$$

Es.:

$\Delta t = 6.8\ s$

$h = ?$



$t_{A \to B} = ?$

$a = g = \text{const}$

$x_0 = 0$

$v_0 = 0$

$$h = \frac{1}{2} a \cdot t^2$$

$$h = \frac{1}{2} g \cdot t_{AB}^2 \Rightarrow t_{AB} = \sqrt{\frac{2h}{g}}$$

$$t_{B \to A} = \frac{h}{v_0}$$

$$\sqrt{2\frac{h}{g}} + \frac{h}{v_0} = \Delta t$$

$$v_0 \sqrt{\frac{2h}{g}} + h = v_0 \Delta t$$

$$h + v_0\sqrt{\frac{2}{g}} \cdot \sqrt{h} - v_0 \Delta t = 0$$

$$\sqrt{h} = x$$

$$x^2 + v_0\sqrt{\frac{2}{g}}\, x - v_0 \Delta t = 0$$

$$x = \frac{-v_0\sqrt{\frac{2}{g}} + \sqrt{v_0^2 \frac{2}{g} + 4 v_0 \Delta t}}{2} = 13.82 \cdot [m$$

$$h = x^2 = \left(13.82\sqrt{m}\right)^2 \cong$$

$$\cong 190\,m$$