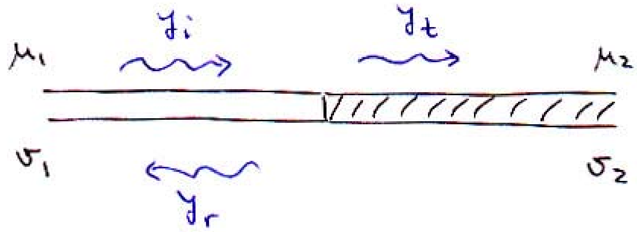
SOLUCIÓN EJERCICIO 20

i)



(0.5 ptos)

En $x = 0$ se cumple

$$\left.\begin{aligned} y_i + y_r &= y_t \\ y_i' + y_r' &= y_t' \end{aligned}\right\} \ (*)$$

(0.5 ptos)

si $y_i = A\cos(k_1 x - \omega t)$ con $k_1 = \dfrac{v_1}{\omega}$

$y_r = B\cos(k_1 x - \omega t)$

$y_t = C\cos(k_2 x - \omega t)$

(0.5 ptos)

se tiene

$$A + B = C$$

$$A k_1 - B k_1 = C k_2$$

(1 pto)

entonces, resolviendo este sistema

$$B = \frac{k_1 - k_2}{k_1 + k_2} A = \frac{v_2 - v_1}{v_1 + v_2} A$$

$$C = \frac{2 k_1}{k_1 + k_2} A = \frac{2 v_2}{v_1 + v_2} A$$

(1 pto)

Si $v_2 = \alpha v_1 \Rightarrow$

$$\boxed{\begin{aligned} B &= \left(\frac{\alpha - 1}{\alpha + 1}\right) A \\ C &= \frac{2\alpha}{\alpha + 1} A \end{aligned}}$$

(0.5 ptos)

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ii) La potencia transmitida está dada por

$$P = \frac{1}{2}\mu\omega^2 A^2 v \qquad \text{(0.5 ptos)}$$

entonces

$$\frac{P_t}{P_{incidente}} = \frac{\frac{1}{2}\mu_2\omega^2 C^2 v_2^2}{\frac{1}{2}\mu_1\omega^2 A^2 v_1^2}$$

$$\frac{P_t}{P_{incidente}} = \frac{\mu_2}{\mu_1}\left(\frac{v_2}{v_1}\right)^2\left(\frac{C}{A}\right)^2 \qquad \text{(0.5 ptos)}$$

pero $v_2 = \alpha v_1 \Rightarrow \mu_1 = \alpha^2\mu_2$

$$\therefore \boxed{\frac{P_t}{P_{in}} = \frac{4\alpha^2}{(1+\alpha)^2}} \qquad \text{(0.5 ptos)}$$

Analogamente

$$\frac{P_r}{P_{in}} = \frac{\frac{1}{2}\mu_1\omega^2 B^2 v_1^2}{\frac{1}{2}\mu_1\omega^2 A^2 v_1^2}$$

$$\frac{P_r}{P_{in}} = \left(\frac{B}{A}\right)^2 = \left(\frac{\alpha-1}{1+\alpha}\right)^2 \qquad \text{(0.5 ptos)}$$