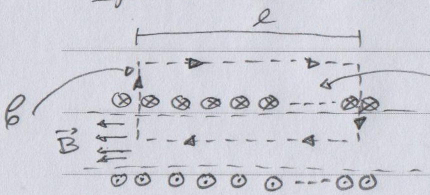
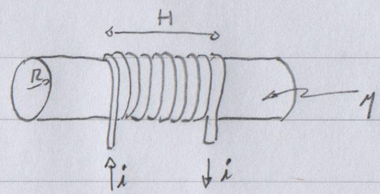
Ejercicio 1 = (a)





n conductores por longitud ℓ de enrollado.

$$\oint_{\mathcal{C}} \vec{B}\cdot\vec{d\ell} = \mu i \rightsquigarrow B\ell = \mu n i \Rightarrow B = \mu \frac{n i}{\ell}$$

$$\frac{n}{\ell} = \frac{N}{H}$$

$$\boxed{|\vec{B}| = \mu \frac{N i}{H}}$$

(b) $$\phi_B = R^2\pi B N = \frac{R^2\pi N^2 \mu}{H} i$$

$$\frac{d\phi_B}{dt} = -\mathcal{E}_{ind} \Rightarrow -\mathcal{E}_{ind} = \underbrace{\frac{R^2\pi N^2\mu}{H}}_{= L}\frac{di}{dt}$$

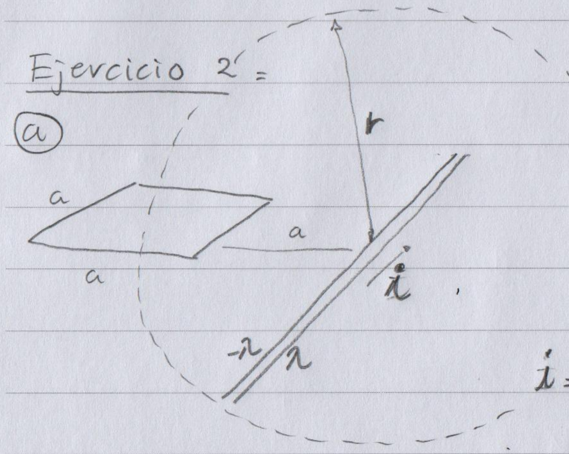
(c) $$\omega_{res} = \omega = \frac{1}{\sqrt{LC}}$$

$$\omega^2 = \frac{1}{LC} \Rightarrow L = \frac{1}{\omega^2 C} \Rightarrow \frac{R^2\pi N^2\mu}{H} = \frac{1}{\omega^2 C}$$

$$\boxed{\mu = \frac{H}{R^2 N^2 \omega^2 \pi C}}$$

Ejercicio 2 =

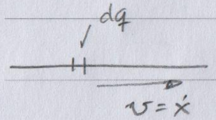
(a)



$$\oint_{\mathcal{C}} \vec{B}\cdot\vec{d\ell} = \mu_0 i$$

$$i = 2\lambda\frac{dx}{dt}$$

$$i' = \frac{dq}{dt} = \lambda\frac{dx}{dt} = \lambda v$$



$$|\vec{B}|\,2\pi r = \mu_0 2\lambda\frac{dx}{dt}$$

$$B = \frac{\lambda\mu_0}{\pi r}\frac{dx}{dt}$$

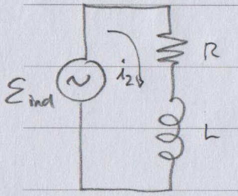
$$\mathcal{E}_{ind} = -\frac{d\phi_B}{dt} \qquad \phi_B = \iint_{\text{Espira}} \vec{B}\cdot\vec{dA} = \int_a^{2a} \frac{\lambda\mu_0}{\pi r}\frac{dx}{dt}\, a\, dr =$$

$$= \frac{\lambda\mu_0 a}{\pi}\frac{dx}{dt}\ln(2) \Rightarrow \mathcal{E}_{ind} = -\frac{\lambda\mu_0 a \ln(2)}{\pi}\frac{d^2x}{dt^2}$$

$$\mathcal{E}_{ind} = +\frac{\lambda\mu_0 a}{\pi}\ln(2)\,\omega^2 x_0\cos(\omega t)$$

$$\boxed{i = \frac{\mathcal{E}_{ind}}{R} = \frac{\lambda\mu_0 a\ln(2)\,\omega^2 x_0\cos(\omega t)}{\pi R}}$$

(b) $\mathcal{E}_{ind} = \mathcal{E}_0 \cos(\omega t)$ $\quad \mathcal{E}_0 = \dfrac{\lambda \gamma_0 \omega^2 a \ln(2) X_0}{\pi R}$



$$\mathcal{E}_{ind} = R i_2 + L \frac{d i_2}{dt} \qquad i_2 = i_{20} e^{j\omega t}$$

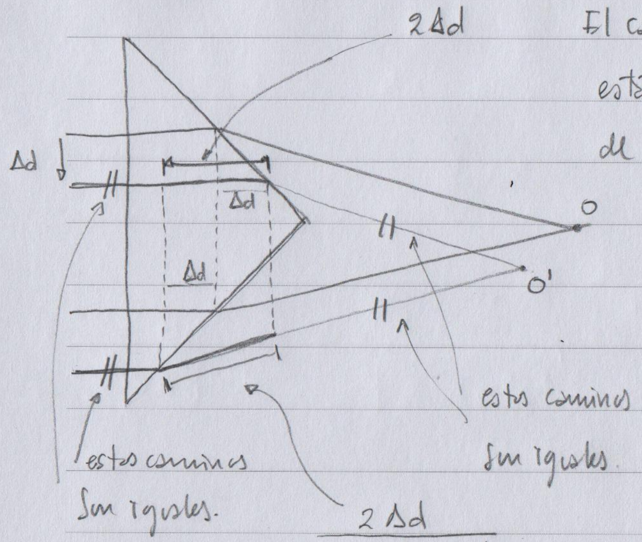
$$\mathcal{E}_0 e^{j\omega t} = \left(R i_{20} + j\omega L i_{20}\right) e^{j\omega t}$$

$$i_{20} = \frac{\mathcal{E}_0}{R + j\omega L} = \frac{\mathcal{E}_0}{\sqrt{R^2+\omega^2 L^2}} e^{+j\varphi} \qquad \boxed{\varphi = -\mathrm{Atg}\left(\frac{\omega L}{R}\right)}$$

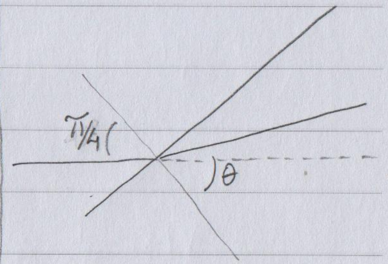
(c) $\langle P \rangle = \mathcal{E}_{rms}\, i_{rms} \cos\varphi = \dfrac{\mathcal{E}_0}{\sqrt{2}} \cdot \dfrac{i_{20}}{\sqrt{2}} \cos\varphi$

$$\boxed{\langle P \rangle = \frac{\mathcal{E}_0^2 \cos\varphi}{2\sqrt{R^2+\omega^2 L^2}}}$$

Ejercicio 3 (a)



El campo eléctrico de interferencia está determinado por la diferencia de camino óptico Δl de los haces.



Snell $\quad n\dfrac{\sqrt{2}}{2} = \operatorname{sen}\theta$

$$\cos\theta = \sqrt{1 - n^2/2}$$

$$\cos(\theta - \pi/4) = \cos\theta \frac{\sqrt{2}}{2} + \operatorname{sen}\theta \frac{\sqrt{2}}{2} =$$

$$= \frac{\sqrt{2}}{2}\sqrt{1-\frac{n^2}{2}} + \frac{n}{2} =$$

$$= \frac{\sqrt{2-n^2} + n}{2}$$

$$\Delta l = 2\Delta d\, n - \frac{4\Delta d}{\sqrt{2-n^2}+n} = \underbrace{\left(2n - \frac{4}{\sqrt{2-n^2}+n}\right)}_{K} \Delta d$$

$$\Delta l = K \Delta d$$

$$\vec{E} = \vec{E}_A + \vec{E}_B = 2\vec{E}_0 \cos\left(\frac{k\Delta l}{2}\right) e^{j\omega t}$$

$$\frac{k\Delta l}{2} = \frac{\pi}{\lambda} K \Delta d$$

$$|\vec{E}| = 2 E_0 \cos\left(\frac{\pi K \Delta d}{\lambda}\right)$$

(b) Máximo interferencia $\quad \dfrac{\pi K \Delta d}{\lambda} = \pm m\pi$

$m = 0, 1, 2, \ldots$

$$\Delta d = \pm \frac{m\lambda}{K}$$

$$\boxed{\Delta d = \pm \frac{m\lambda}{\left[2n - \frac{4}{\sqrt{2-n^2} + n}\right]}}$$