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Data: 09/11/20

P2 - Elt 225

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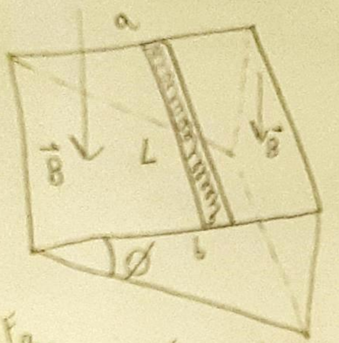
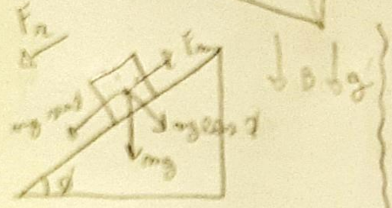


L, m, R, sem atrito, ∅ em relação a Horizontal, resistência dos trilho desprezível, B uniforme para baixo.

$V_0 = 0\ m/s$,

a)



$$\left.\begin{matrix} mg\,\text{sen}\,\phi - F_m = ma \\ F_m = ILB\cos\phi \end{matrix}\right\} mg\,\text{sen}\,\phi - ILB\cos\phi = ma$$

$$\boxed{a = g\,\text{sen}\,\phi - \frac{ILB}{m}\cos\phi}$$

$$|e| = RI = B\frac{dS}{dt} = BvL\cos\phi \Rightarrow I = \frac{B}{R}vL\cos\phi$$

$a = g\,\text{sen}\,\phi - v\dfrac{B^2L^2}{Rm}\cos^2\phi$. Para obter a velocidade terminal $a = 0$, então:

$$g\,\text{sen}\,\phi = \frac{vB^2L^2\cos^2\phi}{Rm} \Rightarrow \boxed{v = \frac{Rmg\,\text{sen}\,\phi}{B^2L^2\cos^2\phi}}$$

b) $I = \dfrac{B}{R}vL\cos\phi = \dfrac{BL}{\cancel{R}} \cdot \dfrac{\cancel{R}mg\,\text{sen}\,\phi}{B^2L^2\cos^2\phi}\cancel{\cos\phi} \Rightarrow \boxed{I = \dfrac{mg\,\text{sen}\,\phi}{BL\cos\phi}}$

c) $P = I^2R = \boxed{\dfrac{Rm^2g^2\,\text{sen}^2\phi}{B^2L^2\cos^2\phi}}$

d) g ~~F~~ mg sen∅ a uma velocidade v, então

$$P = Fv = mg\,\text{sen}\,\phi \cdot \frac{Rmg\,\text{sen}\,\phi}{B^2L^2\cos^2\phi}$$

$$P = \frac{Rm^2g^2\,\text{sen}^2\phi}{B^2L^2\cos^2\phi}$$

②

Y = Norte
X = Sul

} como nos imãs a magnetização ocorre do norte para o sul, somado a lei de Faraday, havendo uma tensão e corrente que tendem a diminuir a variação do fluxo, utilizando a regra da mão direita, apontando o polegar no sentido Norte → sul, obtemos uma corrente no sentido desejado. Assim, confirmamos que Y é Polo norte e X o sul.

③ $E = e^{\alpha y} \cos(6.28 \times 10^9 t + 204 y)\vec{a_x} \left[\frac{V}{m}\right]$

μ_0

a) $H = H_0 \, e^{\alpha y} \cos(6.28 \times 10^9 t + \quad y - 25^\circ)\vec{a_z} \left[\frac{A}{m}\right]$

$\beta = 204, \; \omega = 6.28 \times 10^9$

$\theta_1 = 25^\circ, \; \mu = \mu_0$

como $tg(2\theta_1) = \frac{\sigma}{\omega \varepsilon} = tg(2 \times 25^\circ) = 1.192 \; (1)$

$$\beta = \omega \sqrt{\frac{\mu \varepsilon}{2}} \left(\sqrt{1 + \left[\frac{\sigma}{\omega \varepsilon}\right]^2} + 1 \right)^{1/2} \underset{(1)}{\Rightarrow} 204 = 6.28 \times 10^9 \sqrt{\frac{\mu \varepsilon}{2} (2.556)} \Rightarrow$$

$$\left(\frac{\beta}{\omega}\right)^2 = \frac{\mu \varepsilon_0 \varepsilon_r (2.556)}{2} \Rightarrow \boxed{\varepsilon_r = 74.22}$$

$\sigma = \omega \varepsilon \, tg\, 50 = \boxed{4.918 \; \frac{S}{m}}$

b) $\gamma = \alpha + j\beta =$

$$\alpha = \omega \sqrt{\frac{\mu \varepsilon}{2}} \left(\sqrt{1 + \left(\frac{\sigma}{\omega \varepsilon}\right)^2} - 1 \right)^{1/2} \Rightarrow \alpha = \omega \sqrt{\frac{\mu \varepsilon}{2}} (1.555 - 1)^{1/2} = 95.12 \; \frac{Np}{m}$$

$$\boxed{\gamma = 95.12 + j\,204} \; [m^{-1}]$$

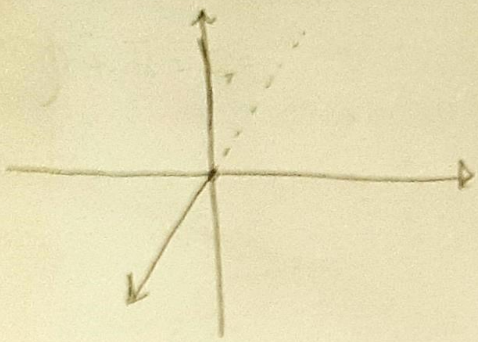
c) $\eta = \sqrt{\frac{\mu}{\varepsilon}} \cdot \frac{1}{\sqrt{\sqrt{1 + \left(\frac{\sigma}{\omega \varepsilon}\right)^2}}} = \frac{\sqrt{\mu_0 / \varepsilon_R \varepsilon_0}}{(1 + 1.42)^{1/4}} = 35.06 \; \Omega$

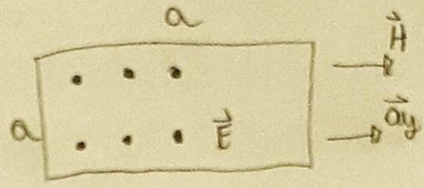
$$P = E_s \times H_s^* = \frac{E_0^2}{2|\eta|} e^{-2\alpha z} \cos(2\theta_n)\vec{a_y} \Rightarrow \boxed{P = \frac{1}{2 \times 35.06} e^{-2 \cdot 95.12 z} \cos(50)\vec{a_y}} \left[\frac{W}{m^2}\right]$$

$$P = 14.26 \times 10^{-3} e^{-190.24 z} \cos(50) = 9.166 \, e^{-190.24 z} \vec{a_y} \left[\frac{mW}{m^2}\right]$$

④ Onda plana uniforme; ω, H_0, sem perdas $(\alpha = 0)$, ε, μ, $\sigma = 0$

Espira: $L = a$





$$E = E_0 \cos(\omega t + \beta x)$$

a) $$\oint_c H\,dl = \int_S \left(\sigma E + \frac{\partial \varepsilon E}{\partial t}\right) dS =$$

Por ser um meio sem perdas temos $\sigma = 0$, logo, $J = \sigma E = 0$

$$\oint_c H\,dl = \int_S \frac{\varepsilon \partial E}{\partial t}\,dS \Rightarrow \quad E = \text{cte} \text{ na área, temos:}$$

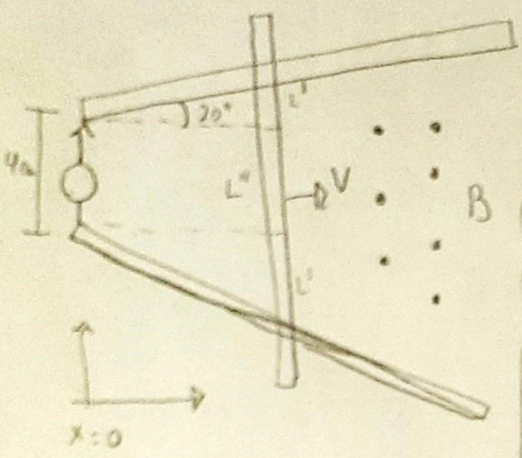
$$\varepsilon \frac{\partial E}{\partial t} = -\varepsilon \sqrt{\frac{\mu}{\varepsilon}}\, H_0 \omega \,\text{sen}(\omega t - \omega\sqrt{\varepsilon\mu}\, x)$$

$$\oint H\,dl = \int_S \varepsilon \frac{\partial E}{\partial t}\,dS = -a^2 \omega \sqrt{\varepsilon \mu}\, H_0 \,\text{sen}(\omega t - \omega\sqrt{\varepsilon\mu}\, x)$$

b) Sendo $I = \int_S \varepsilon \frac{\partial E}{\partial t}\,dS$, temos que o I_d total é dado por:

$$I_d = -a^2 \omega \sqrt{\varepsilon \mu}\, H_0 \,\text{sen}(\omega t - \omega\sqrt{\varepsilon\mu}\, x)$$

⑤ $B = 0{,}4\ Wb/m^2$ // fora do papel e $v = 8\ m/s$ $\qquad v = \frac{\Delta S}{\Delta t} \Rightarrow \boxed{x = vt}$



$tg\,\theta = \frac{L'}{x} \Rightarrow L' = x\,tg\,\theta$

$\boxed{L = y + 2x\,tg\,\theta}$ $\qquad A = 0{,}32t +$

$A = \frac{(y + L)\,x}{2} = \frac{(2y + 2x\,tg\,\theta)\,x}{2} = \boxed{xy + x^2 tg\,\theta}$

$\phi = \int B\,dS = BA = B[xy + x^2\,tg\,\theta]$

$L'' = 4 \times 10^{-2}\ m = y$

$0 < y < 4$

$e = -\frac{d\phi}{dt} = -\frac{d[Byvt + Bv^2 tg\,\theta\,t^2]}{dt} = -[Byv + Byv^2\,tg\,\theta \times (2t)]$

$e = -(0.128 + 18.63t)\ [V]$

6) $x = 100\,t^2 \Rightarrow v = 100t$

$A = xy + x^2\,tg\,\theta = 4t^2 + 3639.7\,t^4$

$\phi = \int_S B\,dS = B(4t^2 + 3639.7\,t^4) = 1.6t^2 + 1455.88\,t^4)$

$e = -\frac{d\phi}{dt} = -(2 \times 1.6\,t + 4 \times 1455.88\,t^3) = -(5823.52\,t^3 + 3.2t)$