TEMĂ SEMINAR 6

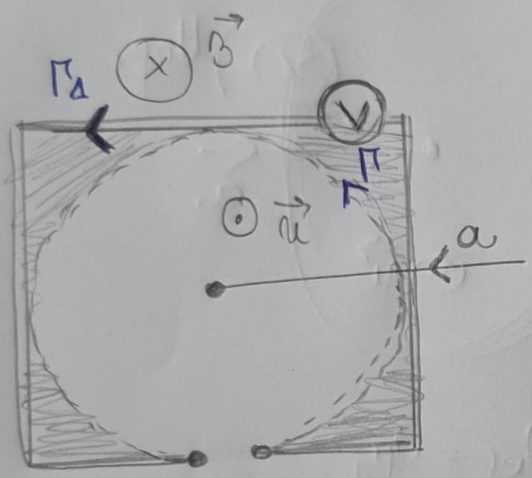
① Spiră circulară : $a = 10cm$, $\overline{B} = B_{ef}\sqrt{2}\sin\omega t$

$B_{ef} = 20\,mT$; Voltmetru conectat la bornele 1-2.

$f_1 = 50Hz$, $f_2 = 10kHz$.

$U_{ef} = ?$ (voltmetru indică tensiunea efectivă).

a)



$$U_\Gamma = -\frac{d}{dt}\cdot\phi_{S_\Gamma} =$$

$$= -\frac{d}{dt}\iint_{S_\Gamma}\vec{B}\cdot d\bar{A} =$$

$$= \frac{d}{dt}\iint_{S_\Gamma} B\cdot dA$$

$$\phi = \iint_{S_\Gamma} B\cdot dA = B\cdot\iint_{S_\Gamma} dA = B\cdot A_{\circ} = B\cdot a^2\cdot\bar{u}$$

$$l_\square = 2a \Rightarrow A_\square = l_\square^2 = 4a^2$$

$$\phi_1 = \iint_{S_{\Gamma_1}}\vec{B}\cdot d\vec{A} = B\cdot A_\square = B\cdot 4a^2$$

$$U_\Gamma = \frac{d}{dt}(Ba^2\bar{u}) \quad , \quad U_{\Gamma_1} = \frac{d}{dt}(B\cdot 4a^2)$$

$U_{\Gamma_1} = 4a^2 \, B_{ef} \, \sqrt{2} \cdot \omega \, \cos(\omega t)$

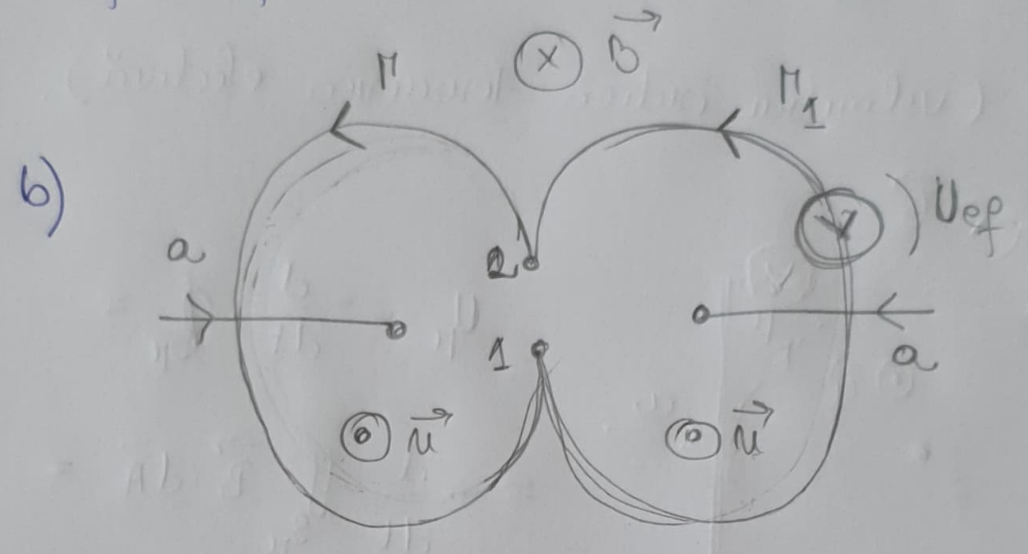
$U_{\Gamma} = 4a^2 \cdot B_{ef} \cdot \sqrt{2} \cdot \omega \cdot \cos(\omega t)$

$\omega = \frac{2\pi}{T} = 2\pi f \Rightarrow \omega_1 = 2\pi f_1 \Rightarrow U_{\Gamma_1}, U_{\Gamma}$

$\omega_2 = 2\pi f_2 \Rightarrow U'_{\Gamma_1}, U'_{\Gamma}$

$U_{ef} = B_{ef} \cdot 4a^2 \cdot \omega$

b)



$U_{\Gamma} = -U_{\Gamma_1}$ $\qquad$ $U_{ef} = U_{\Gamma_1}$

$U_{\Gamma} = -\frac{d}{dt} \phi_{S_\Gamma}$

$\left.\begin{array}{l} \\ \phi_{S_\Gamma} = \iint_{S_\Gamma} \vec{B} \cdot \vec{dA} = -B \cdot A_0 \end{array}\right\} \Rightarrow U_{\Gamma} = \frac{d}{dt} (B \cdot \pi a^2) \Rightarrow$

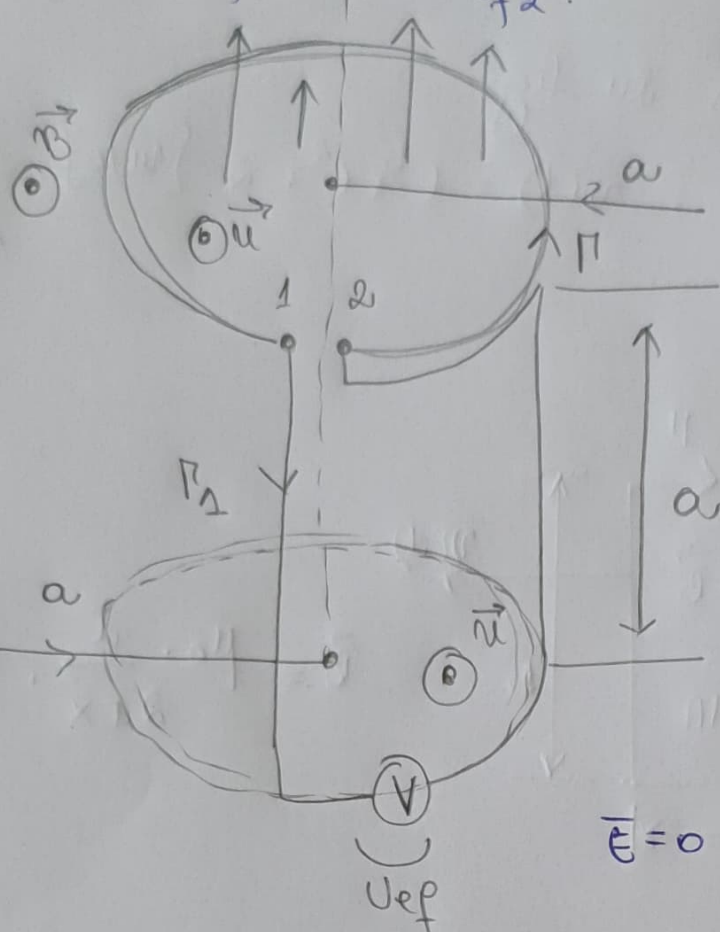
$\Rightarrow U_{\Gamma} = \pi a^2 \, B_{ef} \, \sqrt{2} \cdot \omega \cdot \cos(\omega t).$

$U_{ef} = -U_{\Gamma} = -\pi a^2 \cdot B_{ef} \cdot \omega$

$\omega_1 = 2\pi f_1 \Rightarrow U_{ef_1}$

$\omega_2 = 2\pi f_2 \Rightarrow U_{ef_2}$.

c)



spiră conductoare

$\Downarrow$

$U_{spiră} = 0$

$U_{\Gamma} = \frac{d}{dt} \iint B \cdot dA =$

$= \frac{d}{dt}(B \cdot \pi a^2) =$

$= B_{ef} \cdot \omega \cdot \pi a^2 \cdot \cos(\omega$

$\bar{E} = 0$ în int. sferă.

$U_{\Gamma} = U_{ef}$.

$U_{ef} = \omega \pi a^2 \cdot B_{ef}$.

$\omega_1 = 2\pi f_1 \Rightarrow U_{ef_1}$

$\omega_2 = 2\pi f_2 \Rightarrow U_{ef_2}$.

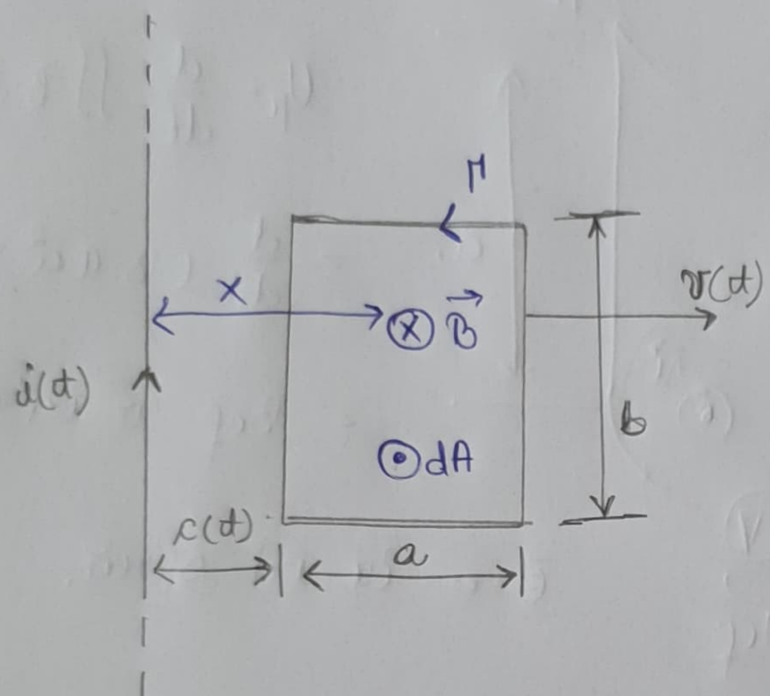
③ Cadru dreptunghiular: $a = 1\,m$, $b = 2\,m$

plasat <u>în aer</u>, $t=0$, $c(0) = 1\,m$

$i(t) = I\sqrt{2}\sin(\omega t)$, $I = 1A$, $f = 5000\,Hz$.

$u = ?$ $v(t)$ ca în fig.

$u = ?$ $t = 1\,s$: $v(t) = t^3 + t^2 + 2\ [m/s]$ în primele 10 secunde.



$$\bar{B} = \mu_0 \cdot \frac{i}{2\pi x} \cdot \bar{k}$$

$$u_\Gamma = -\frac{d}{dt}\Phi_\Gamma$$

$$u_\Gamma = -\frac{d}{dt}\iint_{S_\Gamma} \bar{B}\cdot d\bar{A} = \frac{d}{dt}\iint B\cdot dA = \frac{d}{dt}\iint \frac{\mu_0 \cdot i}{2\pi x}\cdot dx\,dy =$$

$$= \frac{d}{dt}\left(\int_{c(t)}^{c(t)+a} \mu_0 \cdot \frac{i}{2\pi x}\,dx \cdot \int_0^b dy\right) =$$

$$= \frac{\mu_0 \cdot b}{2\pi} \cdot \frac{d}{dt}\left(i(t) \cdot \ln \frac{c(t)+a}{c(t)} \right) =$$

$I\sqrt{2}\sin(wt)$

$$= \frac{\mu_0 \cdot b}{2\pi} \left[w \cdot I\sqrt{2}\cos(wt) \cdot \ln \frac{c(t)+a}{c(t)} + i(t) \frac{c(t)}{c(t)+a} \cdot \right.$$

$$\left. \cdot \left(\frac{c(t)+a}{c(t)} \right)' \right] = \frac{\mu_0 \cdot b}{2\pi} \cdot I\sqrt{2} \left(w\cos w(t) \cdot \ln \frac{c(t)+a}{c(t)} \right.$$

$$+ \sin(wt) \cdot \frac{c(t)}{c(t)+a} \cdot \frac{(c'(t)+a) \cdot c(t) + c'(t)(c(t)+a)}{c^2(t)}$$

$$= \frac{\mu_0 b I\sqrt{2}}{2\pi} \left(w\cos(wt) \cdot \ln \frac{c(t)+a}{c(t)} + \sin(wt) \cdot \frac{2c'(t) \cdot \cancel{c(t)} +}{\cancel{c(t)}} \right.$$

$$+ \frac{a(c(t)+c'(t))}{c(t)} =$$

$$= \frac{\mu_0 b I \sqrt{2}}{2\pi} \left(w\cos(wt) \cdot \ln \frac{c(t)+a}{c(t)} + \sin(wt) \cdot \right.$$

$$\left. \cdot \left(2c'(t) + \frac{a(c(t)+c'(t))}{c(t)} \right) \right).$$

$v(t) = t^3 + t^2 + 2$, $t = 1\,s \Rightarrow v(1) = 4\,m/s$.