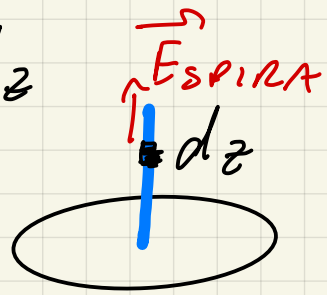
1) $dF_z(z) = dq_2 \, E_z^{SPIRA}$ $\qquad dq_2 = \lambda_2 dz$



$$F_z = \int_0^h \lambda_2 dz \, E_z^{SPIRA} \qquad E_z^{SPIRA} = \frac{\lambda_1 R z}{2\varepsilon_0 (z^2+R^2)^{\frac{3}{2}}}$$

$$F_z = \frac{\lambda_1 \lambda_2 R}{2\varepsilon_0} \int_0^h \frac{z\,dz}{(z^2+R^2)^{3/2}} = \frac{\lambda_1 \lambda_2 R}{4\varepsilon_0} \int_{R_2}^{R^2+h^2} \frac{dy}{y^{3/2}} =$$

$$= \frac{\lambda_1 \lambda_2}{2\varepsilon_0} \left(1 - \frac{R}{\sqrt{R^2+h^2}}\right)$$

2) $\quad E(x) = \frac{\Delta V(x)}{h} = \frac{Q}{h C(x)} \qquad C(x) = \frac{a x \varepsilon_2}{h} + \frac{a(a-x)\varepsilon_1 \varepsilon_2}{h}$

$$E(x) = \frac{Q}{a\varepsilon_0 [a\varepsilon_2 + x(1-\varepsilon_1)]} \qquad E_0(x_{MAX}) = E_{02}$$

$$x_{MAX} = \frac{a\varepsilon_2 - \frac{Q}{a\varepsilon_0 E_{02}}}{\varepsilon_2 - 1} = 1.2 \text{ cm}$$

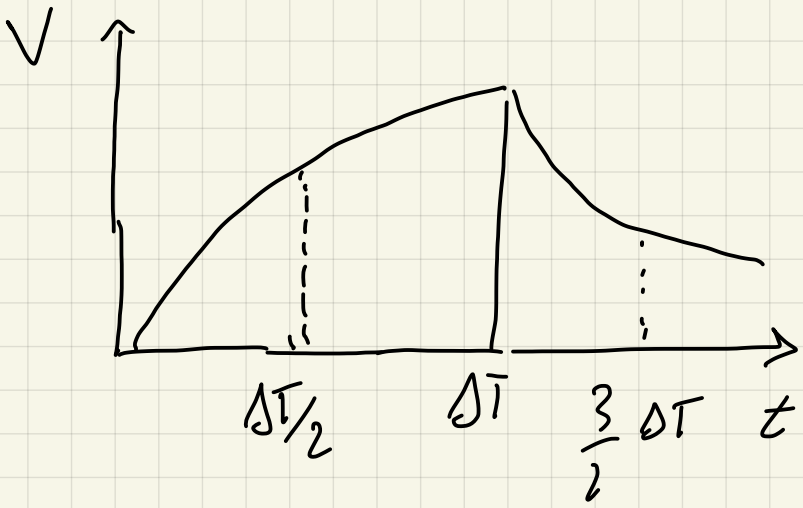
3) $0 < t < \Delta t \qquad \tau = RC \qquad \Delta V_C = \mathcal{E}\left(1 - e^{-\frac{t}{\tau}}\right)$

$$\Delta V_c\left(t=\frac{\Delta t}{2}\right)=5.7\,V$$

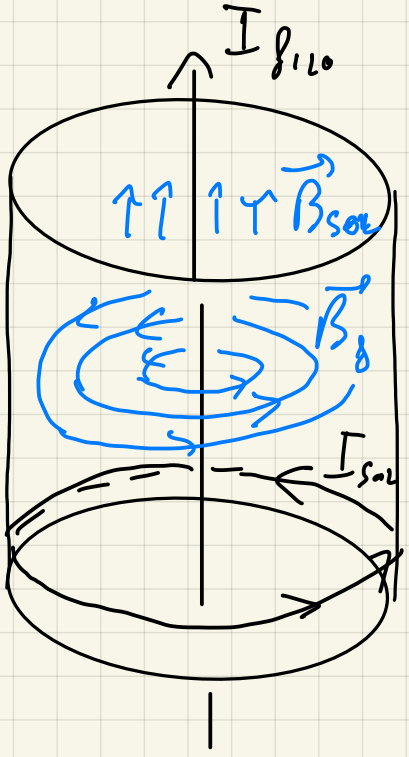
$$t>\Delta t \qquad Q_c(t=\Delta t)=C\mathcal{E}\left(1-e^{-\frac{\Delta t}{\tau}}\right)=Q_0'$$

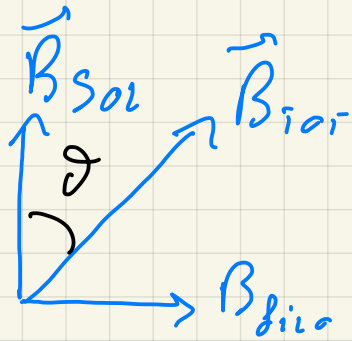
$$Q(t>\Delta t)=Q_0' e^{-\frac{t-\Delta T}{\tau}}$$

$$\Delta V_c\left(t=\frac{3}{2}\Delta T\right)=\mathcal{E}\left(1-e^{-\frac{\Delta T}{\tau}}\right)e^{-\left\{\frac{3/2\,\Delta T-\Delta T}{\tau}\right\}}=6.9\,V$$



5)





$$B_{sol}=\mu_0 n I_{sol}$$

$$B_{filo}=\frac{\mu_0 I_{fil}}{2\pi R}$$

$$\operatorname{tg}\vartheta=\frac{B_{filo}}{B_{sol}}=\frac{\mu_0 I_{fil}}{2\pi R\,\mu_0 n I_{sol}}$$

$$\vartheta=\operatorname{arctg}\left\{\frac{I_{fil}}{I_{sol}}\,\frac{1}{n 2\pi R}\right\}=0.9$$

ES 5

$$\vec{E} = \vec{E}_0 \cos(\vec{k}\cdot\vec{r} - \omega t)$$

$$\vec{J}_s = \sigma \frac{d\vec{E}}{dt} = -\sigma_0 \omega \vec{E}_0 \operatorname{sen}(\vec{k}\cdot\vec{r} - \omega t)$$

$\omega = 2\pi\nu$

$$\langle I \rangle = \frac{E_0^2}{2Z_0}$$

$$J_s^{MAX} = \sigma_0 (2\pi\nu) E_0 = \sigma_0 (2\pi\nu) \sqrt{2Z_0 \langle I \rangle}$$

$$\Rightarrow J_s^{MAX} = 4.8 \times 10^{-5} \, A/m^2$$