Ley Integral de Ampère

$$\oint \vec{B} \cdot d\vec{l} = \mu_0 I_{\text{enc}}$$

$$\vec{\nabla} \cdot \vec{E} = \frac{\rho}{\epsilon_0} \qquad \vec{\nabla} \cdot \vec{B} = 0$$

$$\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t} \quad \vec{\nabla} \times \vec{B} = \mu_0 \vec{J} + \mu_0 \epsilon_0 \frac{\partial \vec{E}}{\partial t}$$

$$\vec{\nabla} \times \vec{B} = \mu_0 \vec{J} + \mu_0 \epsilon_0 \frac{\partial \vec{E}}{\partial t} \rightarrow \oint \vec{B} \cdot d\vec{l} = \mu_0 I_{\text{enc}}$$

$$B = \mu_0 \mu_r \frac{NI}{L}$$

$$= NI$$

$$= \frac{l_{carac}}{\mu_0 \mu_r S_{eff}}$$

$$= \mathcal{F}/\mathcal{R}$$

$$\mathcal{R}_{\phi} = \frac{(l_c + l_{fe}) - x}{\mu_0 * S_{disp}}$$

$$\mathcal{R}_{fe} = \frac{l_{fe}}{\mu_0 \mu_r * S_{fe}}$$

$$\mathcal{R}_{disp\ c} = \frac{l_c}{\mu_0 * S_{disp}}$$

$$\mathcal{R}_{aire\ c} = \frac{l_c - x}{\mu_0 * S_c}$$

$$\sum \mathcal{R} = \mathcal{R}_{\phi} + \mathcal{R}_{fe} + \mathcal{R}_{disp\ c} + \mathcal{R}_{aire\ c} \rightarrow \phi = \frac{NI}{\sum \mathcal{R}}$$

$$B_T = \frac{\phi}{S_T} \rightarrow F_T = \frac{1}{2} \frac{B_T^2 * S_T}{\mu_0}$$

$$T_{sim} = 25\ ms \quad T_{step} = 1\ ms \rightarrow 25\ steps$$

$$I(t = 0) = 3{,}5\ A \quad I(t \geq 15\ ms) = 0\ A$$

$$V_{coil} = 13{,}1\ V \quad R_{coil} = 3{,}65\ \Omega$$

$$m_{bar} = 0{,}019\ kg \quad v_{bar\ ini} = 0\ ms^{-1}$$

$$d(t) = \frac{1}{2}at^2 + v_0t + d_0 \rightarrow d = \frac{1}{2}at^2 \rightarrow$$

$$\rightarrow a = \frac{2d}{t^2} \rightarrow F = ma$$