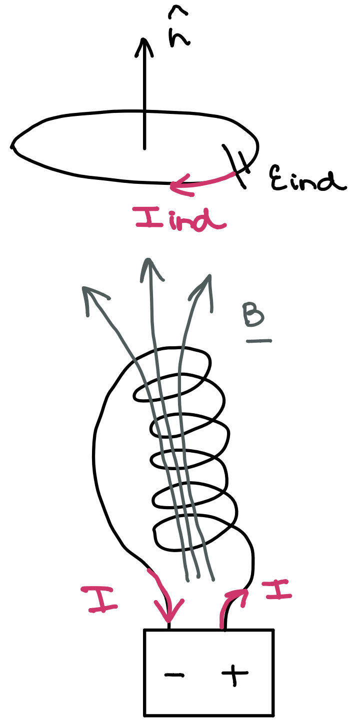
INDUCCIÓN MAGNÉTICA y ley de Faraday-Lenz

$$\varepsilon = -\frac{d\phi_m}{dt}$$ } la variación de flujo magnético por una superficie induce una fuerza electromotriz

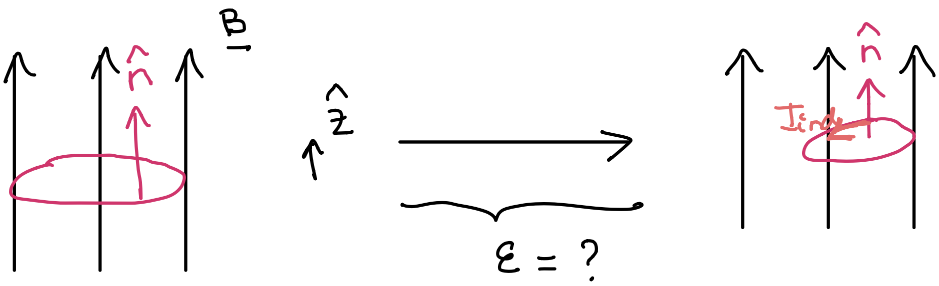
↑ la FEM es tq se intenta oponer a cualquier cambio en el flujo magnético



} aparece al aumentar la corriente I que circula por el solenoide

• signo de ε

campo uniforme $\underline{B} = B_0 \hat{z}$



$$\phi_m = \int_S \underline{B} \cdot \hat{n} \, dS = B_0 A$$

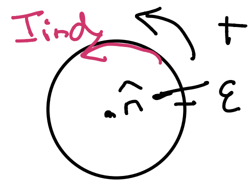
$\underline{B} \parallel \hat{n}$ — área espira

$\phi_m > 0$ — está disminuyendo A

$$\frac{d\phi_m}{dt} < 0 \rightarrow \varepsilon = -\frac{d\phi_m}{dt}$$ (neg, <0)

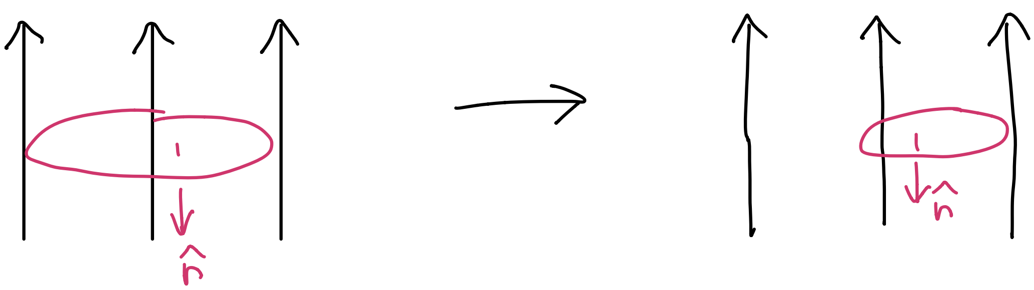
$\Rightarrow \quad \mathcal{E} > 0$

como definí $\hat{n}$ en $\hat{z}$



+ o anti - horario

• si defino $\hat{n} = -\hat{z}$

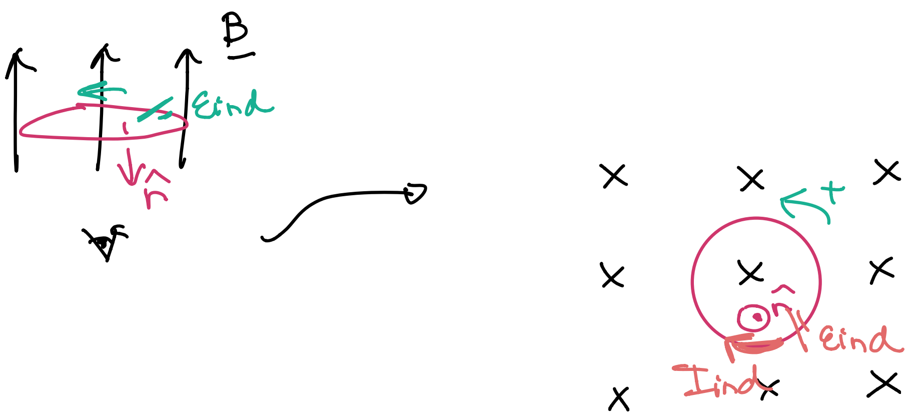


$\phi_n < 0$ y $\underline{B}$ anti-paralelo a $\hat{n}$

como A disminuye $\rightarrow \left| \frac{d\phi_n}{dt} \right| < 0$

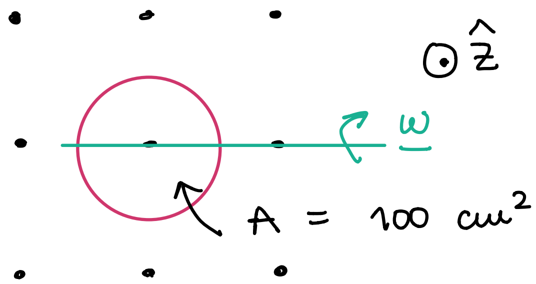
PERO $\phi_n < 0 \rightarrow \frac{d\phi_n}{dt} > 0$

$\hookrightarrow \mathcal{E} = -\frac{d\phi_n}{dt} < 0 \rightarrow$ respecto de $\hat{n}$



PROBLEMA 10

$\underline{B} = B_0 \hat{z}$ con $B_0 = 0.01\,T$

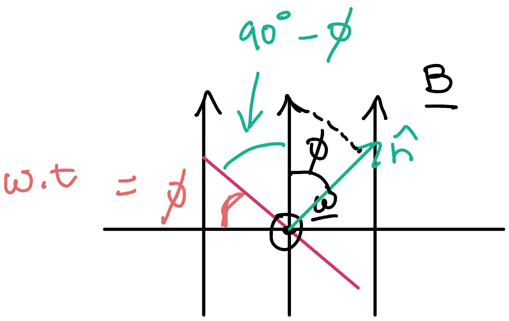


$f = 10 \frac{\text{vueltas}}{s}$

$\Rightarrow \omega = 2\pi f = 2\pi \times \frac{10}{s}$

$N = 1000$ vueltas de cable

$$\varepsilon = -\frac{d\phi_n}{dt}$$



$$\phi_n = \int_S \underline{B} \cdot \hat{n}\ dS$$

S ← sup. de la espira

$$= \int_S B_0 \cos\phi\ dS$$

$$\phi_n = B_0 \cos\phi\ A$$

$$\hookrightarrow \phi_n^{TOT} = N\, B_0 \cos\phi\ A$$

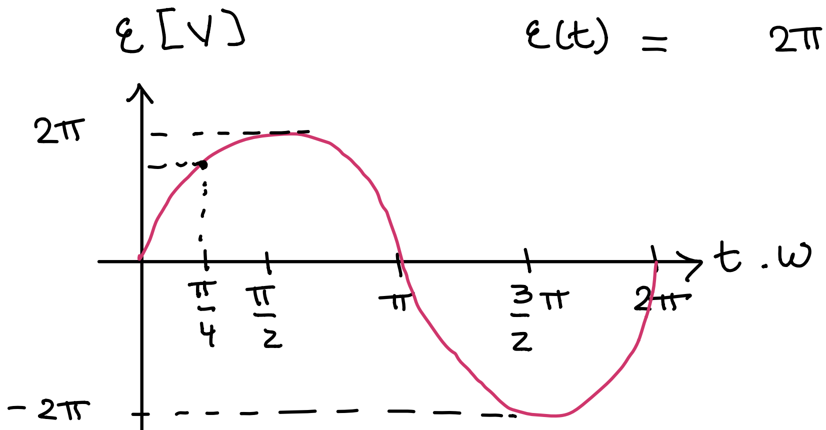
$$\varepsilon = -\frac{d}{dt}\phi_n^{TOT} = -\frac{d}{dt}\left[N B_0 \cos(\underbrace{\omega t}_{\phi}) A\right]$$

$$= -N B_0 A \frac{d}{dt}\left(\cos(\omega t)\right)$$

$$= + N B_0 A \left(+\omega \sin(\omega t)\right)$$

$$\varepsilon(t) = \underbrace{N B_0 A \omega} \sin(\omega t)$$

$$\varepsilon(t) = 2\pi\ V \sin(\underbrace{\omega t}_{\phi})$$



$$\varepsilon(t) = 2\pi V \sin(\omega t)$$

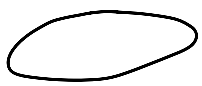
$$\varepsilon(\phi) = 2\pi V \sin(\phi)$$

$$\varepsilon\left(\phi = \frac{\pi}{4}\right) = 2\pi V \underbrace{\sin\left(\frac{\pi}{4}\right)}_{\frac{\sqrt{2}}{2}} \cong 4.44 \cdot V$$

$$\phi = \omega \cdot t \longrightarrow t = \frac{\phi}{\omega} = \frac{\phi}{2\pi} \frac{s}{10}$$

$$\varepsilon_{MAX} \rightarrow \phi_{MÁX} = \frac{\pi}{2} \longrightarrow t = 25 \text{ ms}$$

$$\varepsilon_{MIN} \rightarrow \phi_{MÍN} = \frac{3}{2}\pi \longrightarrow t = 75 \text{ ms}$$



$R =$ cte

$V = I R$ } ley de Ohm

$$V = V(t) \longrightarrow I = I(t) = \frac{V(t)}{R}$$