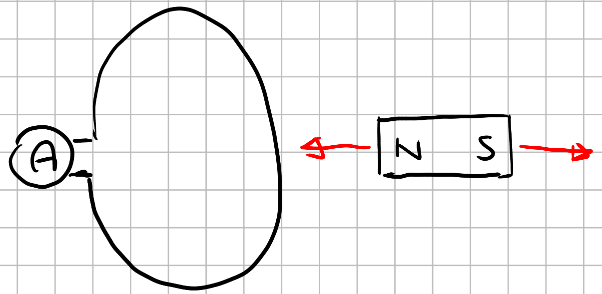
RECAP

$$\vec{\nabla} \cdot \vec{E} = \frac{\rho}{\varepsilon_0} \qquad \vec{\nabla} \cdot \vec{B} = 0$$

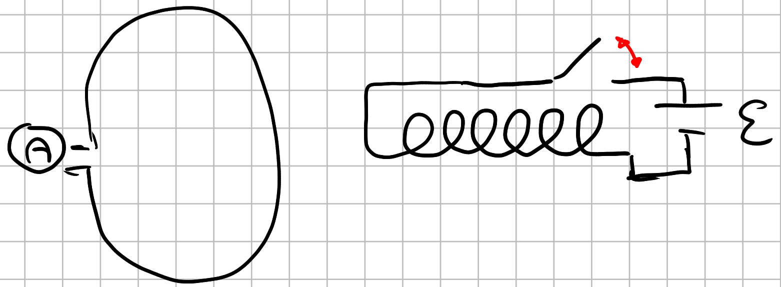
$$\vec{\nabla} \times \vec{E} = 0 \qquad \vec{\nabla} \times \vec{B} = \mu_0 \vec{J}$$

vediamo cosa succede se $\vec{B} = \vec{B}(x, y, z, \boxed{t})$

ESPERIMENTI



se il magnete si muove $\longrightarrow$ corrente



corrente NELLA SPIRA $\neq 0$ solo durante l'apertura e la chiusura dell'interruttore

LEGGE DI FARADAY

$$\underbrace{\oint_{c(t)} \vec{E}\cdot d\vec{s}}_{\mathcal{E}_i} = -\frac{d}{dt}\,\Phi_{c(t)}(\vec{B}) \quad \mapsto$$

$$\mathcal{E}_i = -\frac{d\,\Phi_{c(t)}(\vec{B})}{dt}$$

<u>se</u> $c(t)$ coincide con un circuito allora appare una corrente indotta

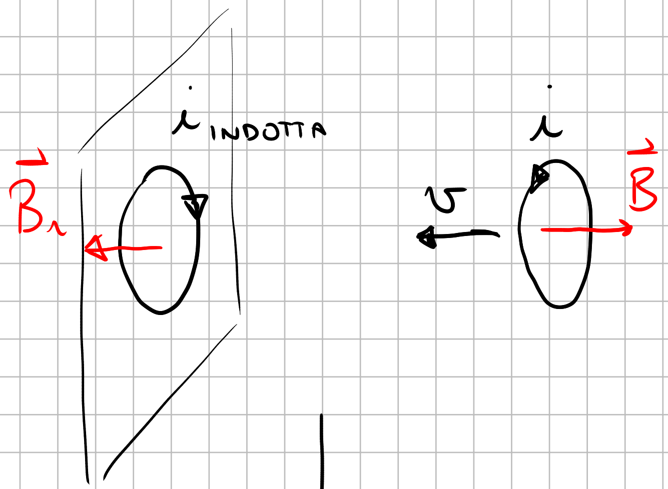
$$i = \frac{\mathcal{E}_i}{\underbrace{R}_{\text{RESISTENZA NEL CIRCUITO}}} = -\frac{1}{R}\,\frac{d\,\Phi_{c(t)}(\vec{B})}{dt} \longrightarrow$$

i genera campi magnetici <u>indotti</u>

LEGGE DI LENZ

$$\mathcal{E}_i = \boxed{-} \frac{d\,\Phi_{C(t)}(\vec{B})}{dt}$$

LEGGE DI LENZ



CON LENZ (-)

N S   S N   LA SPIRA RALLENTA

↓

CONSERVAZIONE ENERGIA ✓

SENZA LENZ (+)

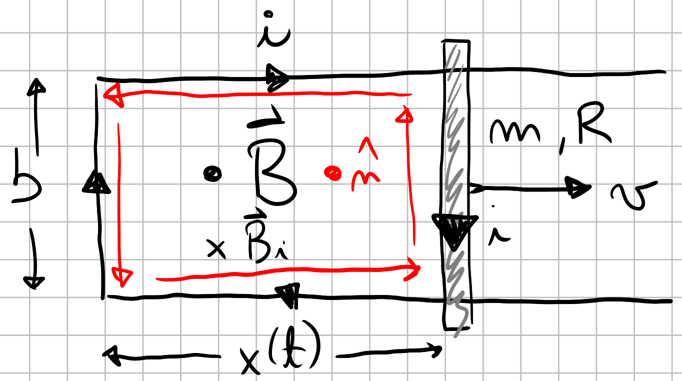
S N   S N   LA SPIRA ACCELERA

CONSERVAZIONE ENERGIA ✗

ESEMPIO

$$\mathcal{E}_i = -\frac{d\,\Phi_{c(t)}(\vec{B})}{dt} = -\frac{d}{dt}\int_{\Sigma(c(t))} \vec{B}\cdot\boxed{\hat{n}}\,d\Sigma$$

COERENTE CON IL VERSO DI PERCORRENZA DI $c(t)$



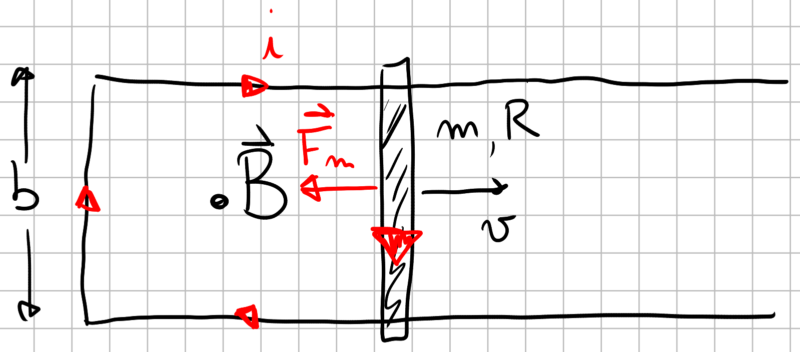
① $\Phi_{c(t)}(\vec{B}) = B\,b\,x(t) \Rightarrow \dfrac{d\,\Phi_{c(t)}(\vec{B})}{dt} = Bbv$

$$\mathcal{E}_i = -\frac{d\,\Phi_{c(t)}(\vec{B})}{dt} = -Bbv\,,\quad i = \frac{\mathcal{E}_i}{R} = \frac{\boxed{-}\,Bbv}{R}$$

VERSO ORARIO

② $\vec{F}_e = -e\,\vec{v}\times\vec{B} \rightarrow$ verso l'alto $\rightarrow$ corrente verso il basso (nella sbarretta)

CONTINUAZIONE



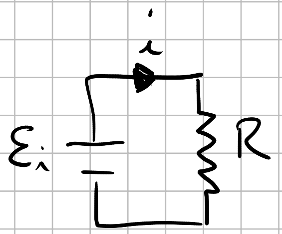
$$|i| = \frac{bBv}{R}$$ intensità di corrente

$$\vec{F}_m = i\,\vec{l} \times \vec{B}$$

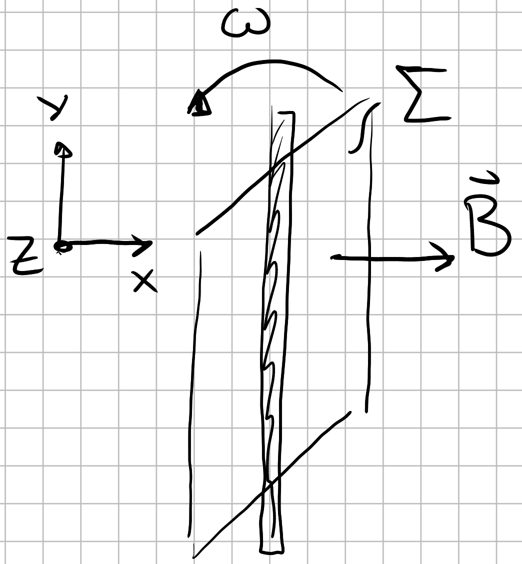
per mantenere v, $\vec{F}_{ext} = -\vec{F}_m$

$$F_m = ibB = \frac{b^2B^2\boxed{v}}{R} \Rightarrow F_{ext} = \frac{b^2B^2v}{R}$$

$$P_{ext} = \frac{dW}{dt} = \frac{F_{ext}\,dx}{dt} = F_{ext}\,v = \frac{b^2B^2v^2}{R} = \mathcal{E}_i\,i \longrightarrow$$



ALTERNATORE



$$\Phi_\Sigma(\vec{B}) = B\Sigma\cos\theta = B\Sigma\cos(\omega t) \Rightarrow$$

$$\frac{d\Phi_\Sigma(\vec{B})}{dt} = B\Sigma\left(-\omega\sin(\omega t)\right) = -\omega B\Sigma\sin(\omega t) \Rightarrow$$

$$\mathcal{E}_i = \omega B\Sigma\sin(\omega t), \Rightarrow i = \frac{\mathcal{E}_i}{R} = \frac{\omega B\Sigma\sin(\omega t)}{R}$$

$$\vec{M} = \boxed{\vec{m}} \times \vec{B}$$

$\hookrightarrow i\Sigma\hat{n}$