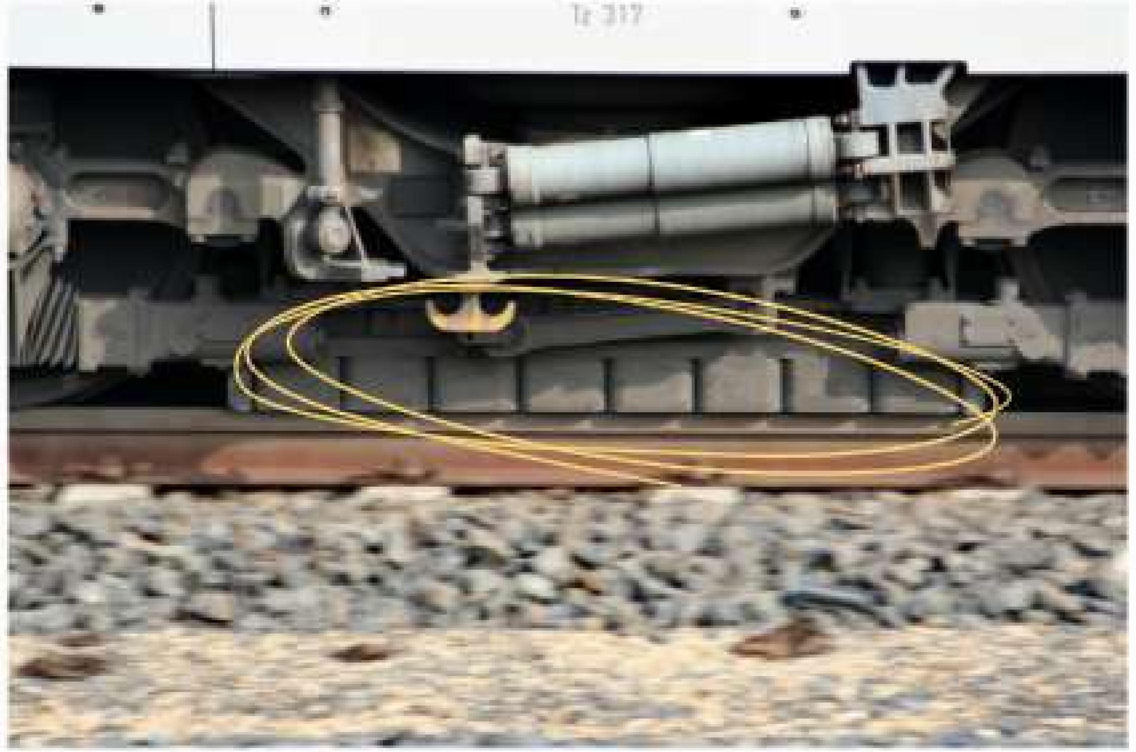

Tz 317

$\begin{cases} \bullet \text{ cariche fisse} \rightarrow \vec{E} \text{ conservativo} \\ \bullet \text{ cariche elettriche in moto stazionario} \rightarrow \vec{B} \text{ solenoidale} \\ \text{SORGENTI + CONDIZIONI AL CONTORNO} \rightarrow \vec{E}, \vec{B} \end{cases}$

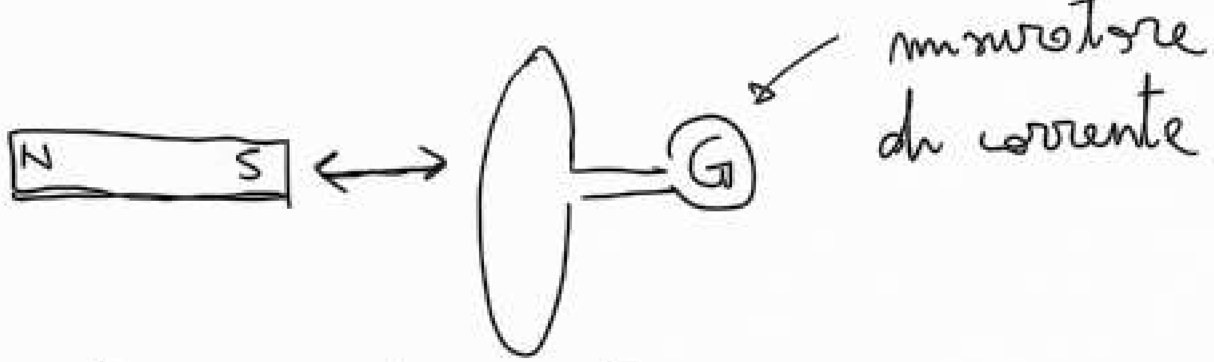
↓ oltre la elettro/magnetostatica

1. un $\vec{B}$ variabile nel tempo → $\vec{E}$ NON conservativo
2. un $\vec{E}$ variabile nel tempo → $\vec{B}$ (sempre solenoidale)

↓

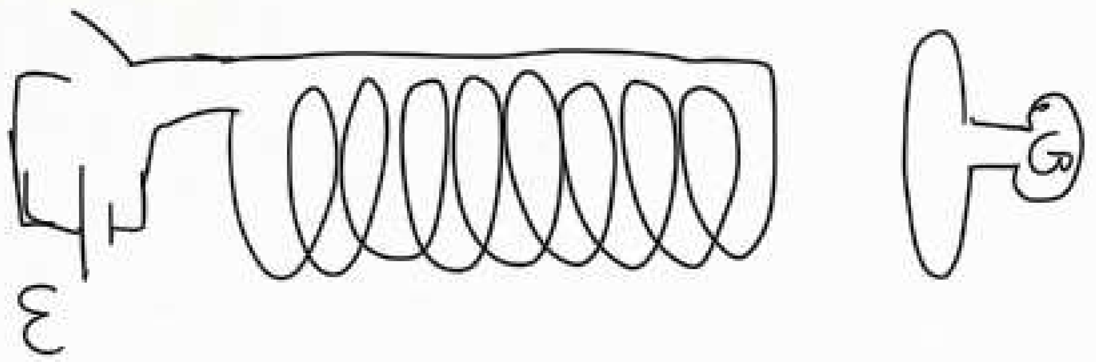
CAMPO ELETTROMAGNETICO

I



- se il magnete è fermo → nessuna corrente
- se il magnete si muove → corrente
  - ↳ se si avvicina → corrente in un verso
  - ↳ se si allontana → corrente nel verso opposto

II



- se accendete o spegnete l'interruttore → corrente
- regime stazionario → nessuna corrente

$$\boxed{\oint_C \vec{E}\cdot d\vec{s}} = \boxed{-\frac{d\Phi_C(\vec{B})}{dt}}$$

LEGGE DI FARADAY

$$\mathcal{E} = \oint_c \vec{E}\cdot d\vec{s}$$

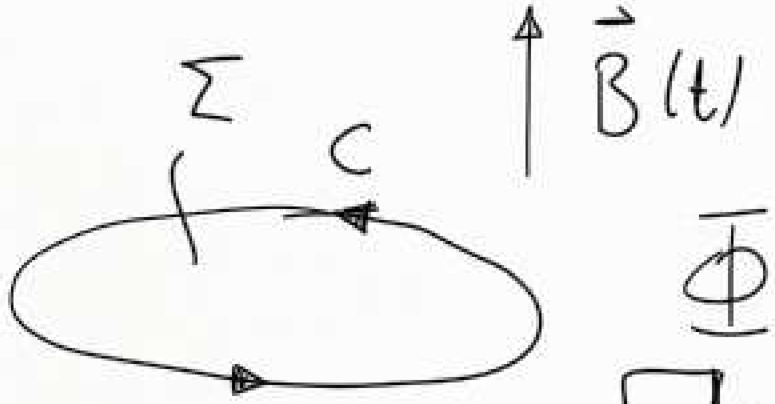
$$\Phi_{\Sigma(C)}(\vec{B}) = \int_{\Sigma(C)} \vec{B}\cdot\hat{n}\, d\Sigma$$

$$\Downarrow$$

$$\boxed{\mathcal{E}_i = -\frac{d\Phi_c(\vec{B})}{dt}} \xrightarrow[\text{di resistenza } R]{\text{SE } C \text{ coincide con un circuito}} \boxed{i = \frac{\mathcal{E}_i}{R} = -\frac{1}{R}\frac{d\Phi_c(\vec{B})}{dt}}$$

$$\mathcal{E}_i = - \frac{d\Phi_c(\vec{B})}{dt}$$

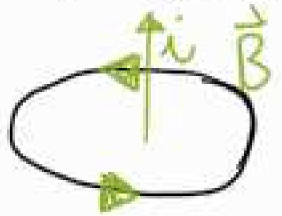
→ legge di Lenz

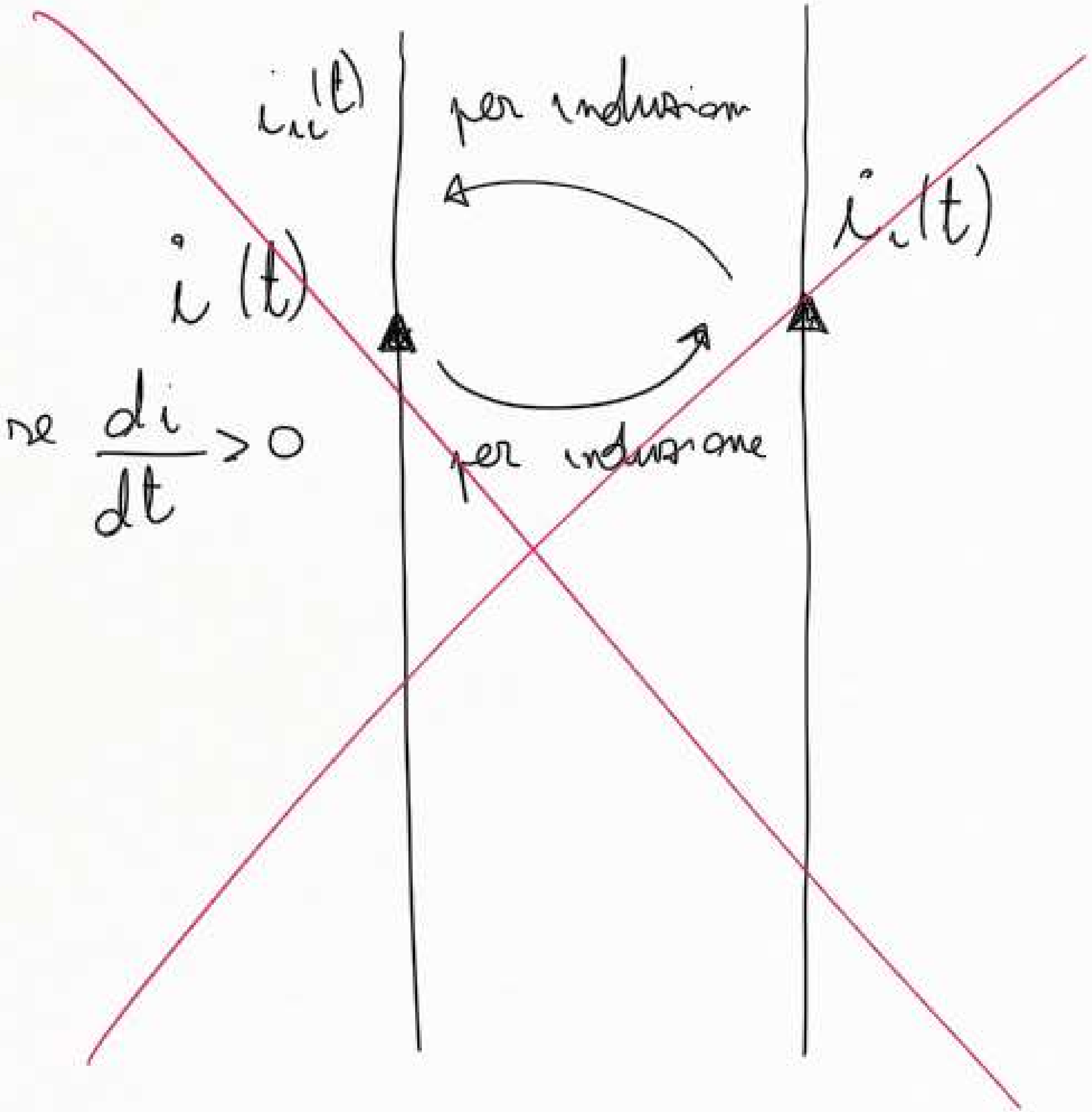


$$\Phi = \Sigma B(t)$$

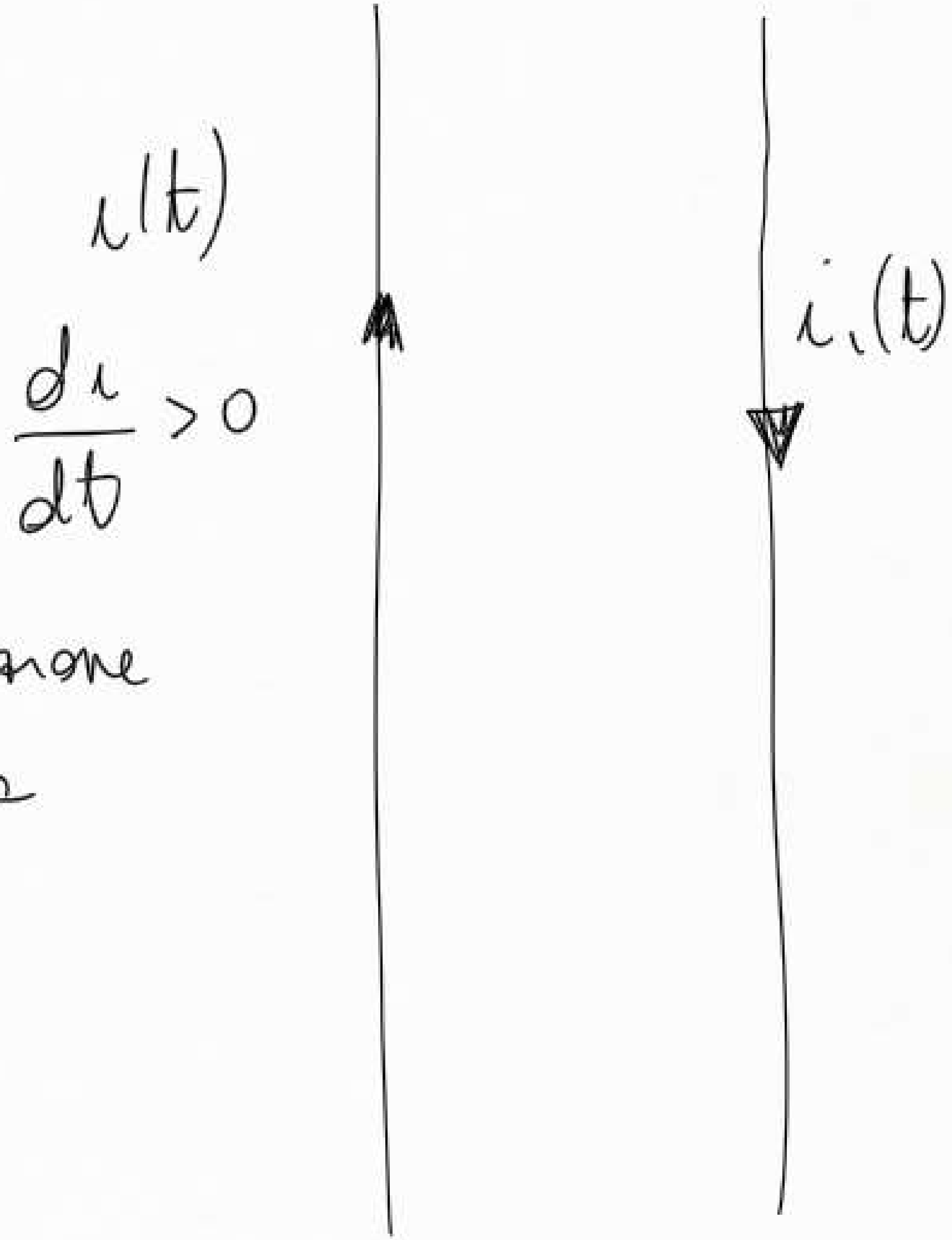
→ se $B(t)$ aumenta, $\frac{d\Phi}{dt} > 0 \Longrightarrow \mathcal{E}_i < 0$ → i ha verso opposto a quello con cui percorriamo C

→ se $B(t)$ diminuisce, $\frac{d\Phi}{dt} < 0 \Longrightarrow \mathcal{E}_i > 0$ → i ha lo stesso verso di C

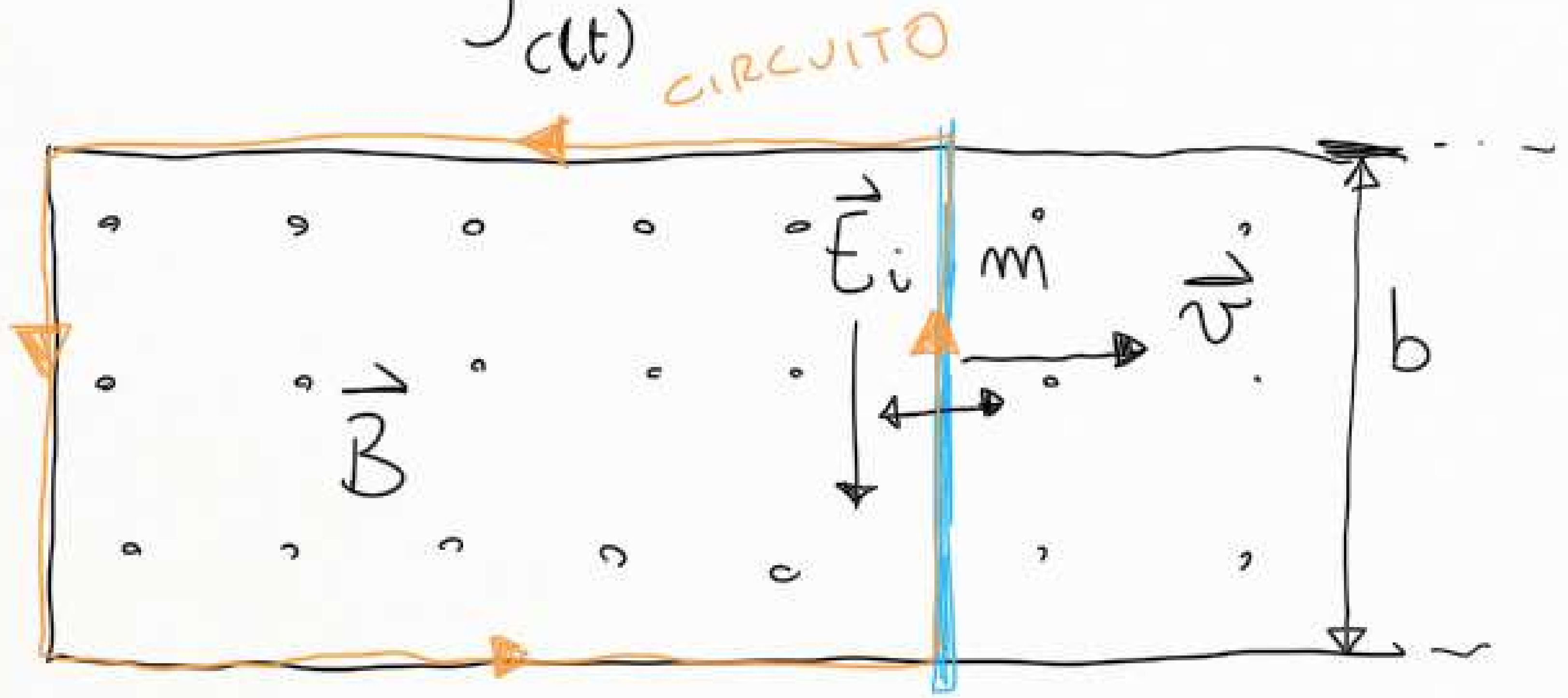




per conservazione
dell'energia



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

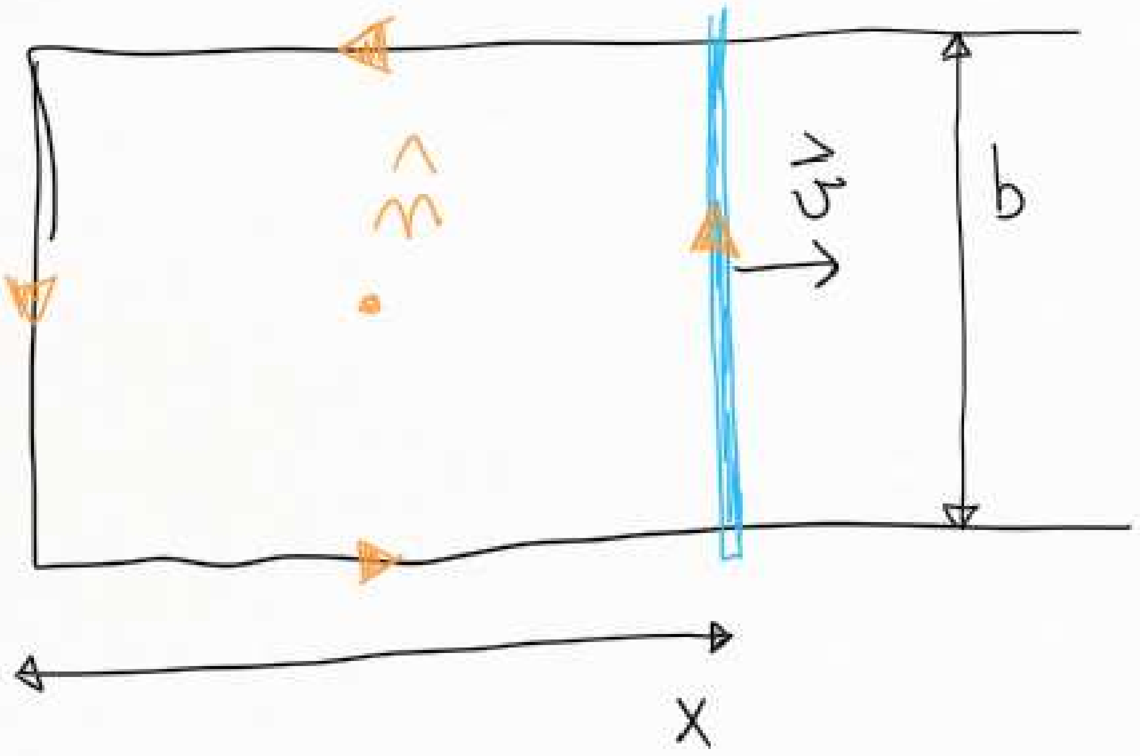


$$\vec{F} = -e\vec{v}\times\vec{B},\quad \vec{E} = \frac{\vec{F}}{q} \Rightarrow$$

$$\vec{E}_i = \frac{\vec{F}}{-e} = \vec{v}\times\vec{B}$$ campo elettromotore

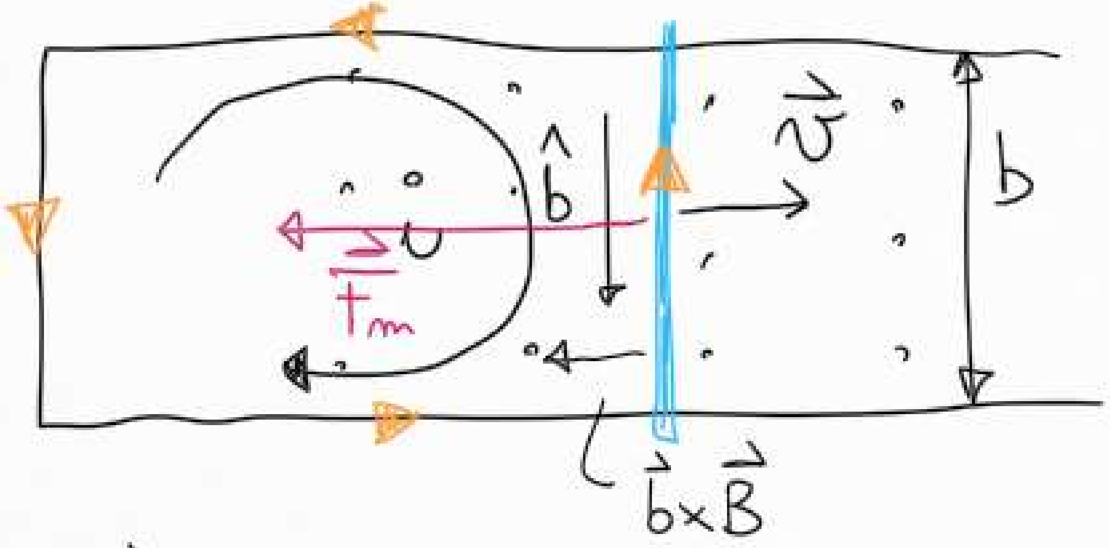
$$\mathcal{E}_i = \oint_{\text{CIRC.}} \vec{E}_i\cdot d\vec{s} = \oint_{\text{CIRC}} \vec{v}\times\vec{B}\cdot d\vec{s} = \int_{\text{SBARR}} \vec{v}\times\vec{B}\cdot d\vec{s} = -vB\int_0^b ds = \boxed{-vBb = \mathcal{E}_i}$$

$$\Phi_{CIRC}(\vec{B}) = \int_{CIRC} \vec{B}\cdot\hat{n}\, d\Sigma = B\int_{CIRC} d\Sigma = Bbx \Rightarrow$$



$$-\frac{d\Phi_{CIRC}}{dt} = -Bb\frac{dx}{dt} = -Bbv = \mathcal{E}_i$$

GENERATORE DI CORRENTE I



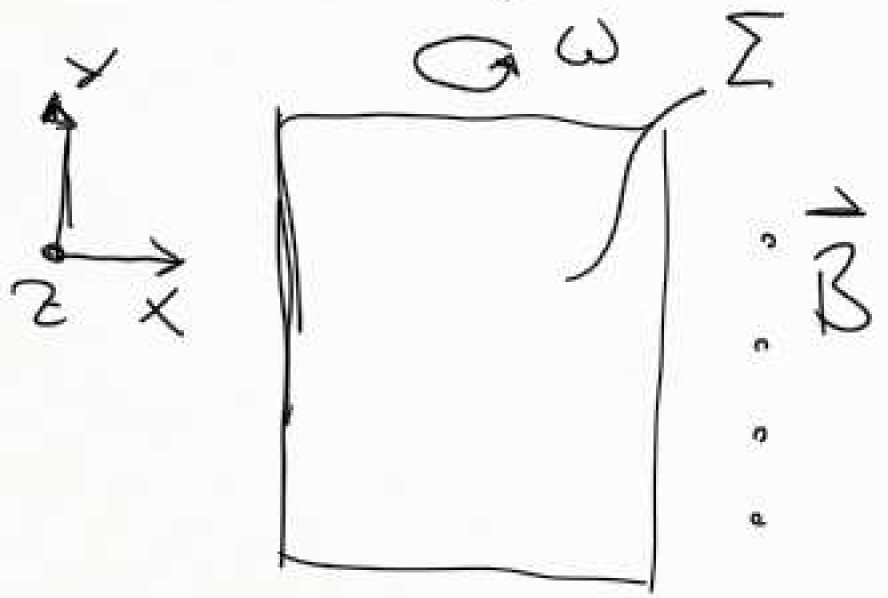
$$i = \frac{\mathcal{E}_i}{R_{TOT}}, \quad \vec{F}_m = i\vec{b} \times \vec{B} = \frac{\mathcal{E}_i}{R_{TOT}} \vec{b} \times \vec{B} =$$

$$= -\frac{B^2 b^2}{R_{TOT}} \vec{v}$$ attrito elettromagnetico

$$\vec{F}_{ext} = -\vec{F}_m = \frac{B^2 b^2 \vec{v}}{R_{TOT}}$$

$$P = \frac{dW}{dt} = \frac{d}{dt}\left(\int \vec{F}_{ext} \cdot d\vec{s}\right) = \frac{F_{ext}\, v\, dt}{dt} = F_{ext}\, v = \frac{B^2 b^2 v^2}{R_{TOT}} = \mathcal{E}_i\, i$$

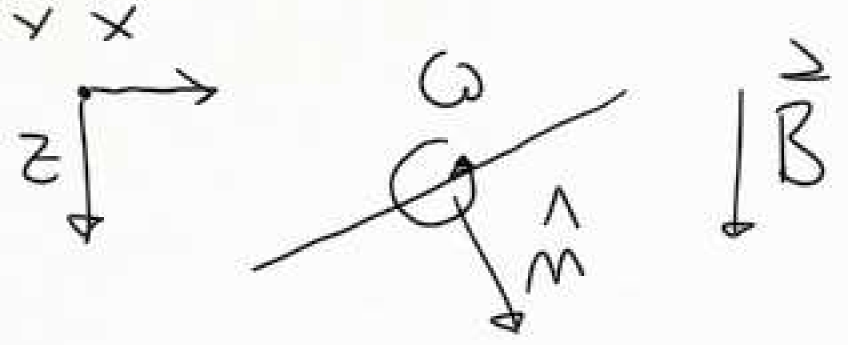
GENERATORE DI CORRENTE ALTERNATA

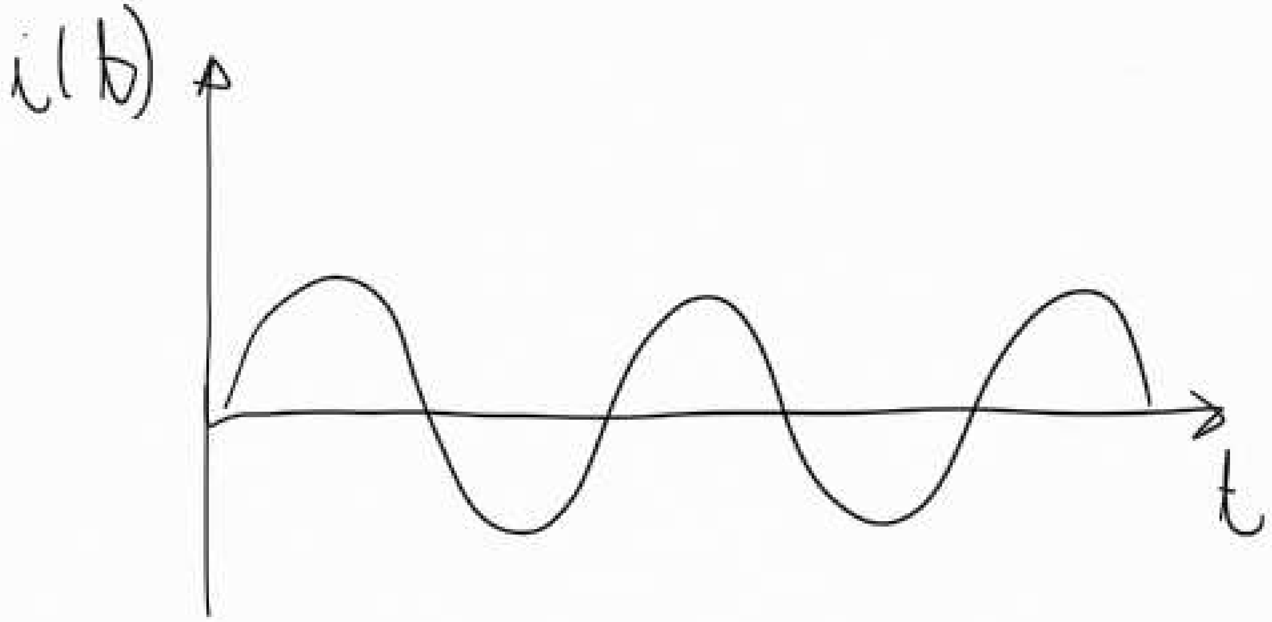


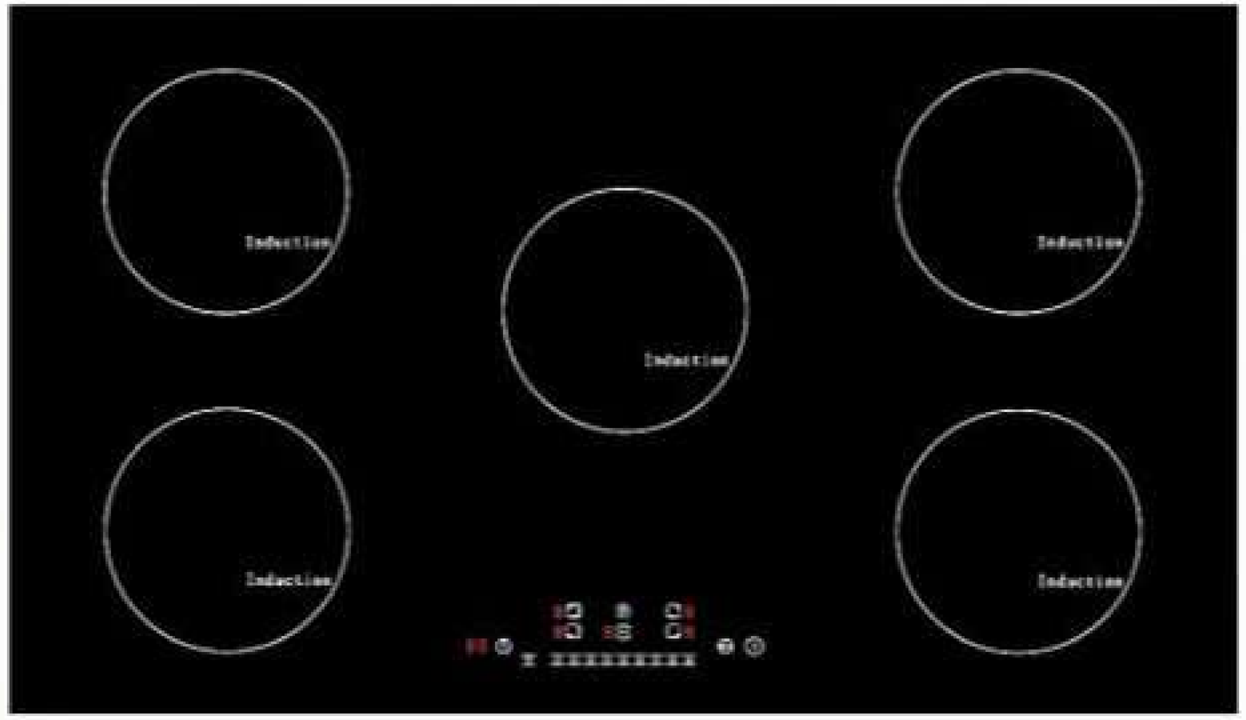
$$\Phi(\vec{B}) = B\Sigma\cos\theta = B\Sigma\cos(\omega t) \Rightarrow$$

$$\mathcal{E}_i = -\frac{d\Phi}{dt} = \omega B\Sigma\sin(\omega t) \Rightarrow$$

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



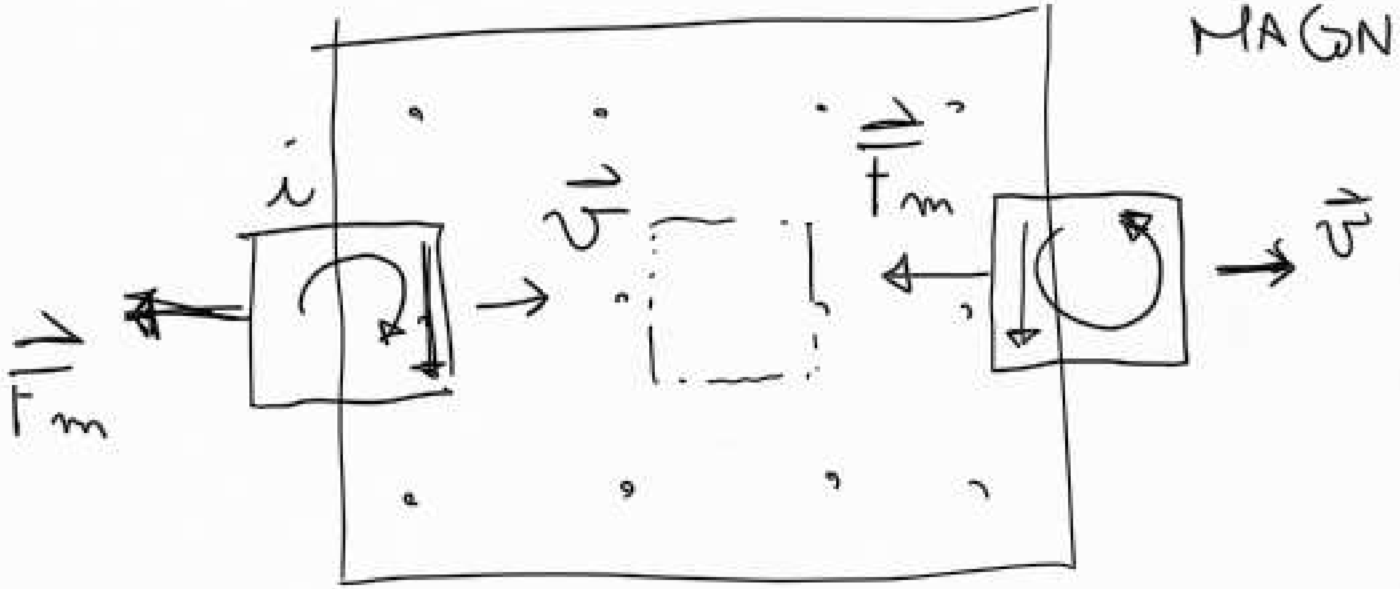




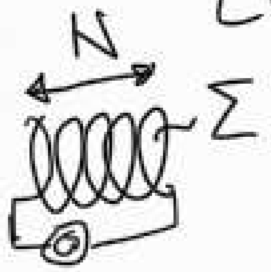
CORRENTI PARASSITE

EDDY CURRENTS

FRENO MAGNETICO



LEGGE DI FELICI

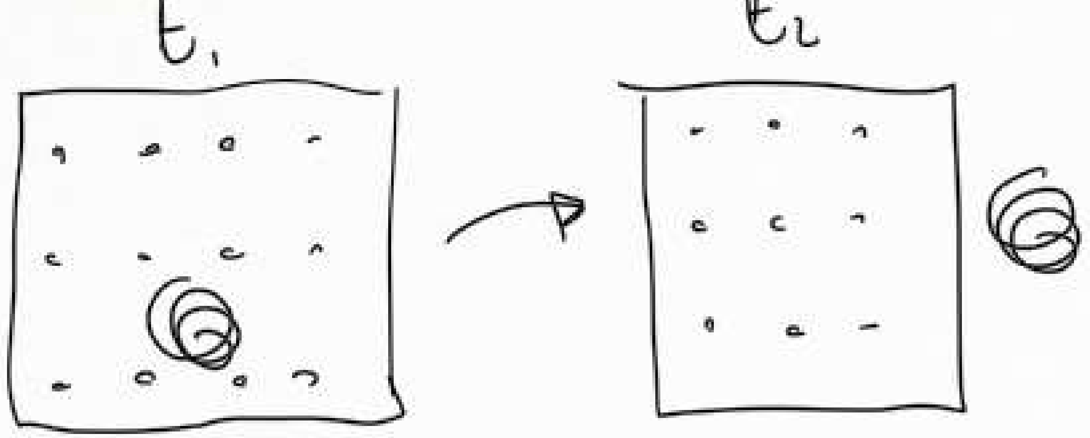


$$i = \frac{dq}{dt}$$

$$q = \int_{t_1}^{t_2} dq = \int_{t_1}^{t_2} i(t)\,dt = -\frac{1}{R}\int_{t_1}^{t_2} \frac{d\Phi}{\cancel{dt}}\cancel{dt} = -\frac{1}{R}\int_{\Phi_1}^{\Phi_2} d\Phi =$$

$$\boxed{q = \frac{\Phi_1 - \Phi_2}{R}}$$ LEGGE DI FELICI

$\Phi = NB\Sigma$ se il campo è uniforme e parallelo alla normale della bobina



$$\left.\begin{aligned} \Phi_1 &= NB\Sigma \\ \Phi_2 &= 0 \end{aligned}\right\} \Rightarrow q = \frac{\Phi_1}{R} = \frac{NB\Sigma}{R} \Rightarrow$$

$$\boxed{B = \frac{qR}{N\Sigma}}$$ misurare il campo magnetico