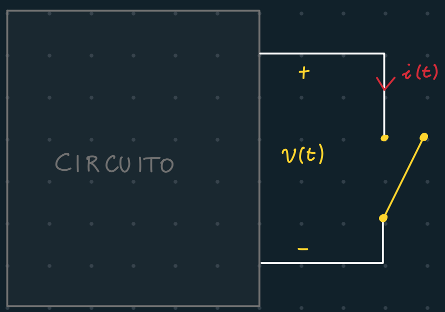
Bipoli Tempo-Varianti

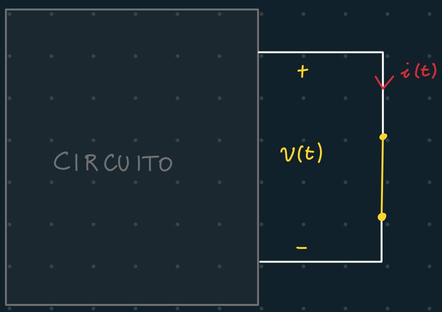
Bipolo interruttore ideale Aperto



E' un Circuito Aperto

$$i(t) = 0$$

Bipolo interruttore ideale Chiuso



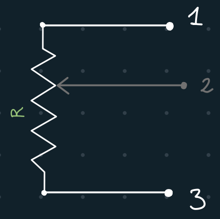
E' un Corto circuito

$$v(t) = 0$$

Esempio di Bipolo Tempo-Variante

$$v(t) = \begin{cases} 2\, i(t) & t > 3s \\ 4\, i(t) & t < 3s \end{cases}$$

Potenziometro



Angolo

$$R_{23} = R(\alpha) \qquad 0 < \alpha < \frac{3}{2}\pi$$

$$R_{12} = R_{13} - R_{23}$$

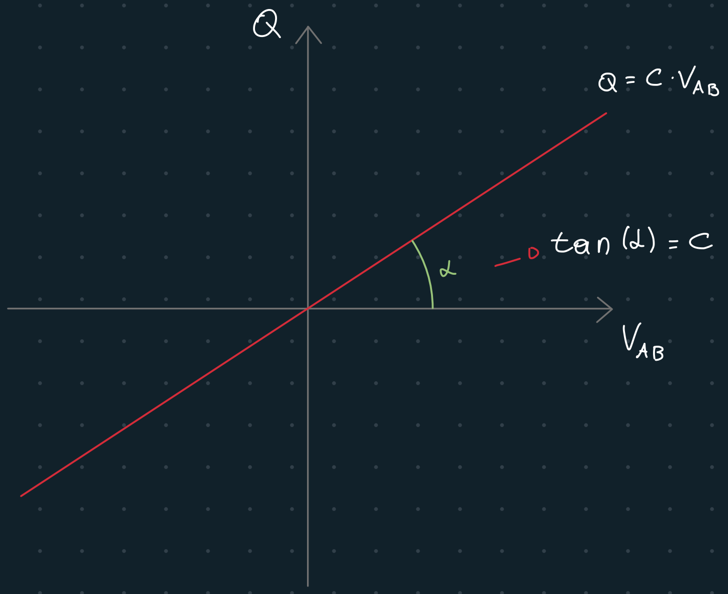
Bipoli Lineari DINAMICI

Caratteristica del condensatore

$$\underset{\text{CARICA TOT}}{Q} = \underbrace{C}_{\text{Capacità}} \cdot \underbrace{V_{AB}}_{\text{Potenziale}} \qquad (1)$$

$$[C] = \frac{Q}{V} \triangleq \text{Farad}$$

"È definito da"



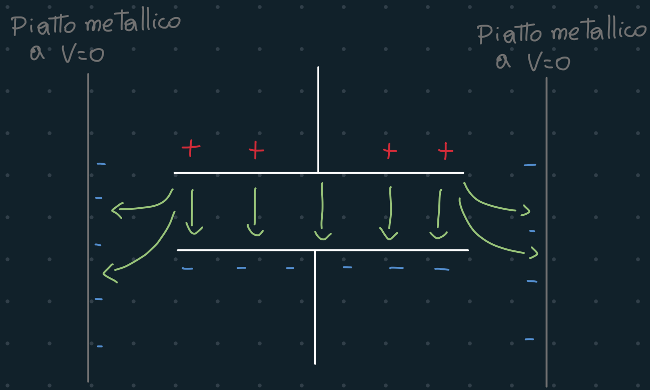
Se $d \ll S$

$$C = \varepsilon \frac{S}{d}$$

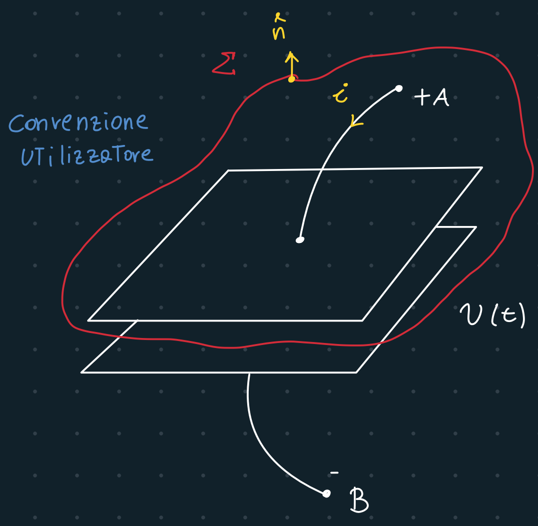
ε: costante dielettrica del mezzo

S: Superficie

d: distanza tra le piastre



Ricavare la caratteristica



Conservazione della carica

$$i_\Sigma(t) = -\frac{dq_\Sigma}{dt}$$

$$-i(t) = -\frac{dq_\Sigma}{dt} \qquad (2)$$

Con il verso scelto (n)
$i_\Sigma = -i(t)$ perché "entra" nella superficie

$$C = \frac{Q}{V_A - V_B} \to Q = C\cdot(V_A - V_B) \quad (1)$$

ma $i(t) = \frac{dQ_A}{dt} \to i(t) = \frac{\overset{\text{cost}}{C}\cdot V_{AB}}{dt}$

$$\Rightarrow \boxed{i(t) = C\cdot\frac{dV_{AB}}{dt}}$$

Caratteristica Condensatore

$$\boxed{i(t) = -C\cdot\frac{dV_{AB}}{dt}}$$

Caratteristica Condensatore Convenzione Generatore

SE c dipende da t

$$\to i(t) = \frac{d}{dt}\left[C\cdot V_{AB}\right] = \frac{dC}{dt}V_{AB} + C\cdot\frac{dV_{AB}}{dt}$$

Condensatore Tempo-Variante

MICROFONO

$$\int_{t_0}^{t} i(\tau)\,d\tau = C\int_{t_0}^{t}\frac{dv}{d\tau}\,d\tau$$

$$\to \int_{t_0}^{t} i(\tau)\,d\tau = C\cdot\left[v(t) - v(t_0)\right]$$

$$\Rightarrow \boxed{v(t) = v(t_0) + \frac{1}{C}\int_{t_0}^{t} i(\tau)\,d\tau}$$

Tensione in funzione della corrente

STORE

$$P_a(t) = v(t)\cdot i(t) = v\cdot C\frac{dv}{dt} = \frac{1}{2}C\frac{dv^2}{dt} = \frac{d}{dt}\left(\frac{1}{2}Cv^2\right)$$

$$\frac{dv^2(t)}{dt} = 2v(t)\frac{dv}{dt}$$

Potenza Assorbita

$$P_a(t) = \frac{dU_a}{dt} \Rightarrow U_a \triangleq \frac{1}{2}Cv^2$$ Energia immagazzinata

$$U_a(t,t_0) = \int_{t_0}^{t}\frac{d}{dt}\left(\frac{1}{2}Cv^2(\tau)\right)dt = \frac{1}{2}Cv^2(t) - \frac{1}{2}Cv^2(t_0)$$

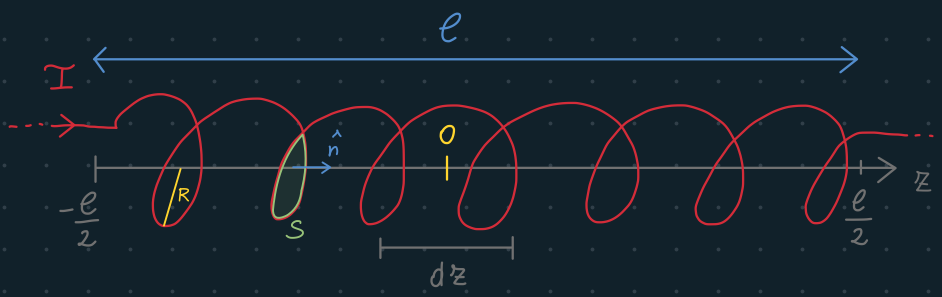
Intervallo di tempo

$t_0 \rightarrow v(t_0)=0 \Rightarrow U_a=0$ Condizione iniziale (1)

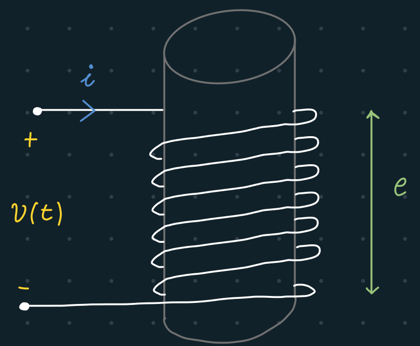
$t_1 > t_0 \rightarrow v(t_1) > v(t_0) \Rightarrow U_a(t_1,t_0) > 0$ Carica (2)

$t_2 > t_1 \rightarrow v(t_2) < v(t_1) \Rightarrow U_a(t_2,t_1) < 0$ Scarica (3)

Il Solenoide



Caratteristica del Solenoide



$$\boxed{\phi = L \cdot i(t)}$$

Auto induzione

Induttanza

$$[L] = \frac{V}{A} s = \Omega\, s$$

Ohm

Secondi

$$v \propto \frac{d\phi}{dt} \rightarrow$$

- $[\phi] = V \cdot s \triangleq$ Weber
- $[\phi] = T \cdot m^2$

Alternative

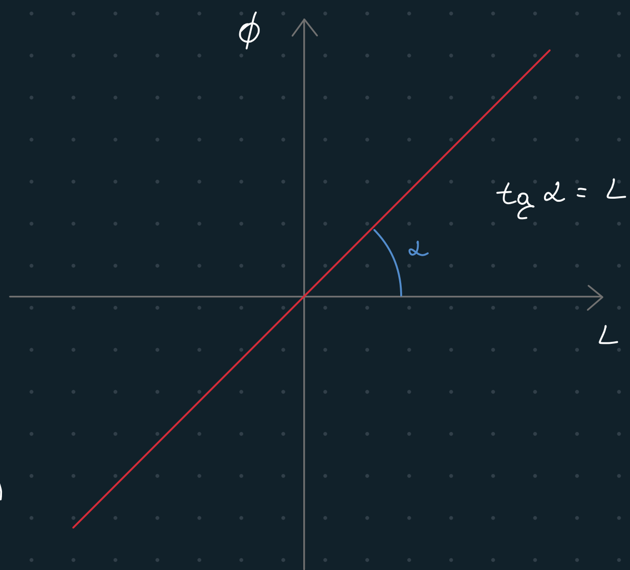
- $[B] = T$ ← Tesla
- $[L] = \dfrac{[\phi]}{[i]} = \dfrac{V}{A} \cdot s = \Omega \cdot s =$ Henry

Calcolare l'induttanza

per un solenoide molto "Lungo"

H.p. $\ell >> R$

$$L = \mu N^2 \frac{S}{\ell} \quad \text{con} \quad L > 0$$



Convenzione utilizzatore

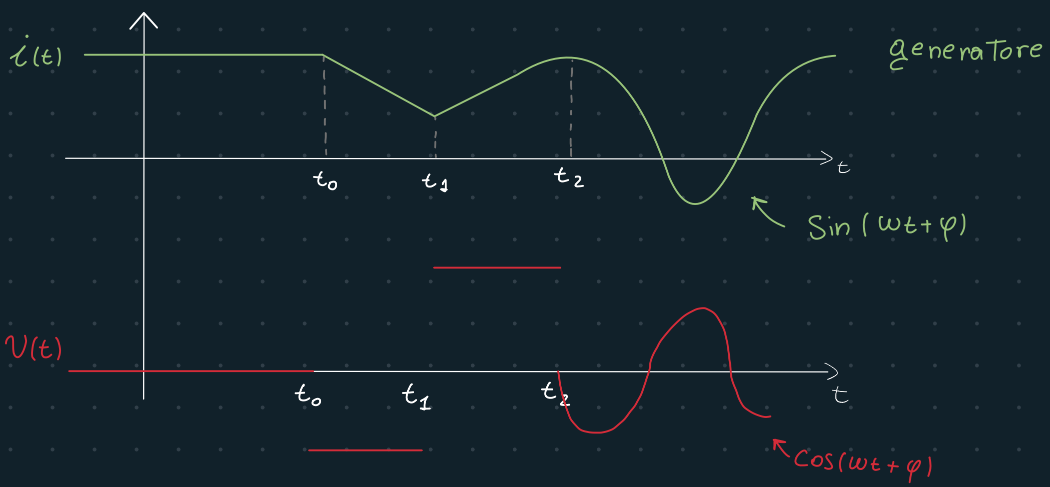
Caratt
Faraday

$$\begin{cases} \phi = L \cdot i(t) \\ v = \dfrac{d\phi}{dt} \end{cases} \Rightarrow v(t) = L \frac{di(t)}{dt}$$

Legame integrale

$$i(t) = i_0(t) + \frac{1}{L}\int_{t_0}^{t} v(\tau)\, d\tau$$

Condizione iniziale



$$P_a(t) = V(t) \cdot i(t) = L \cdot \frac{di}{dt} \cdot i = \frac{d}{dt}\left(\frac{1}{2} L i^2\right)$$

$$U_a(t_1, t_0) = \frac{1}{2} L i^2(t_1) - \frac{1}{2} L i^2(t_0)$$ Energia magnetica