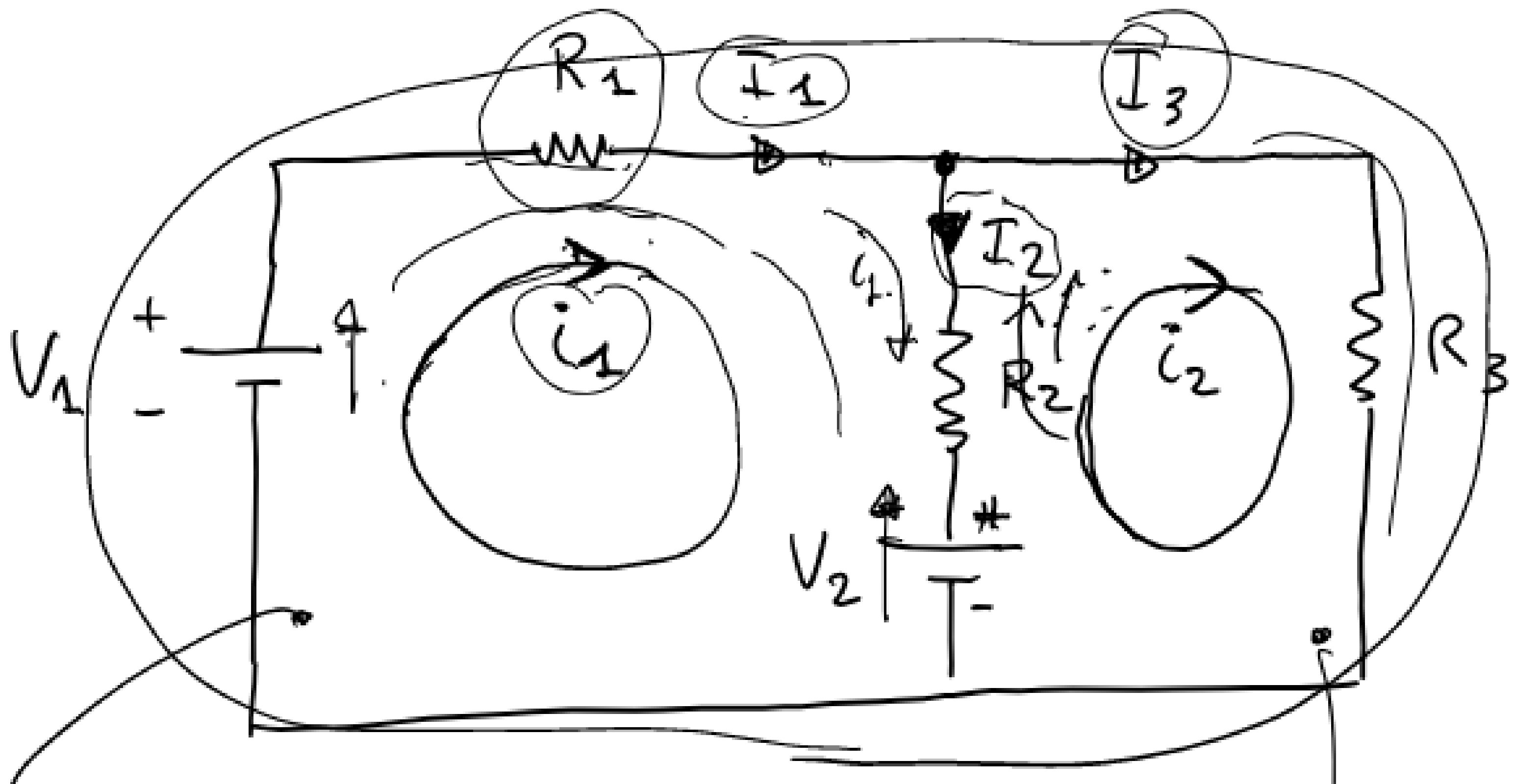
STUDIO DI UNA RETE ELETTRICA



- $V_1, V_2, R_i \ldots \Rightarrow I_1, I_2, I_3$?
- $V_1, R_i \ldots, \boxed{I_2} \Rightarrow V_2$? I_1 I_3

$\sum f_{em} = \sum R i$

Corrente maglia

$$\begin{cases} V_1 - V_2 = R_1 \cdot i_1 + R_2 \cdot i_1 \\ V_2 = R_2 \cdot i_2 + R_3 \cdot i_2 \end{cases} \quad i_1, i_2 \Rightarrow \underline{I_2 = i_1 - i_2}$$

$I_1 = i_1$

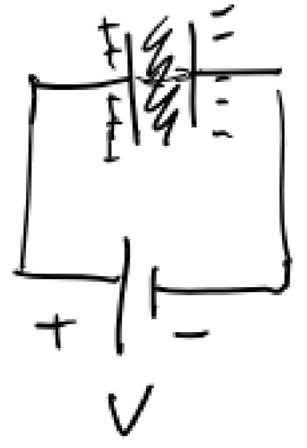
$I_3 = i_2$

$\boxed{I_1 = I_2 + I_3}$

$I_2 = I_1 - I_3$

CONDENSATORE

$$C = \frac{Q}{V_x} \qquad [F] = \text{Farad.}$$



$$\text{df. } P(t) = \frac{dW}{dt}$$

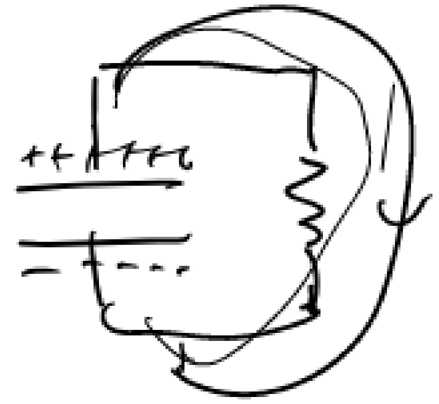
$$q(t) = C \cdot V(t)$$

Circuito con C controllato:

- TRANSITORIO
- Regime

$$i(t) = \frac{dq(t)}{dt} = C \cdot \frac{dV(t)}{dt}$$

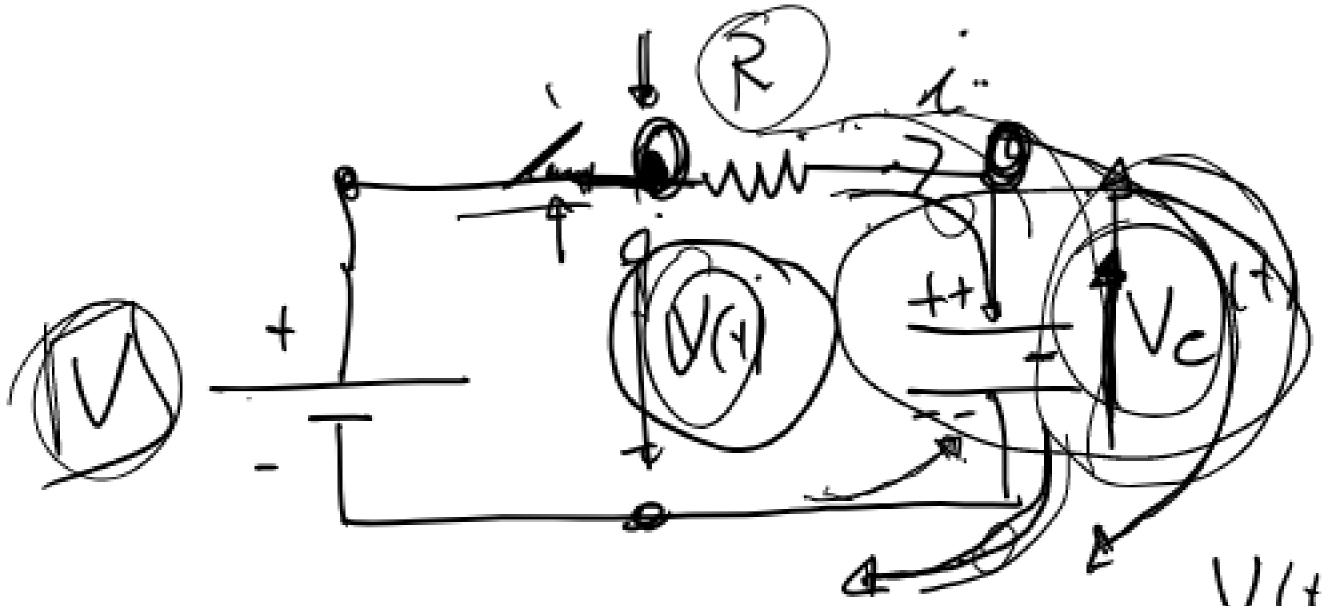
$$\boxed{i(t) = C \frac{dV(t)}{dt}}$$



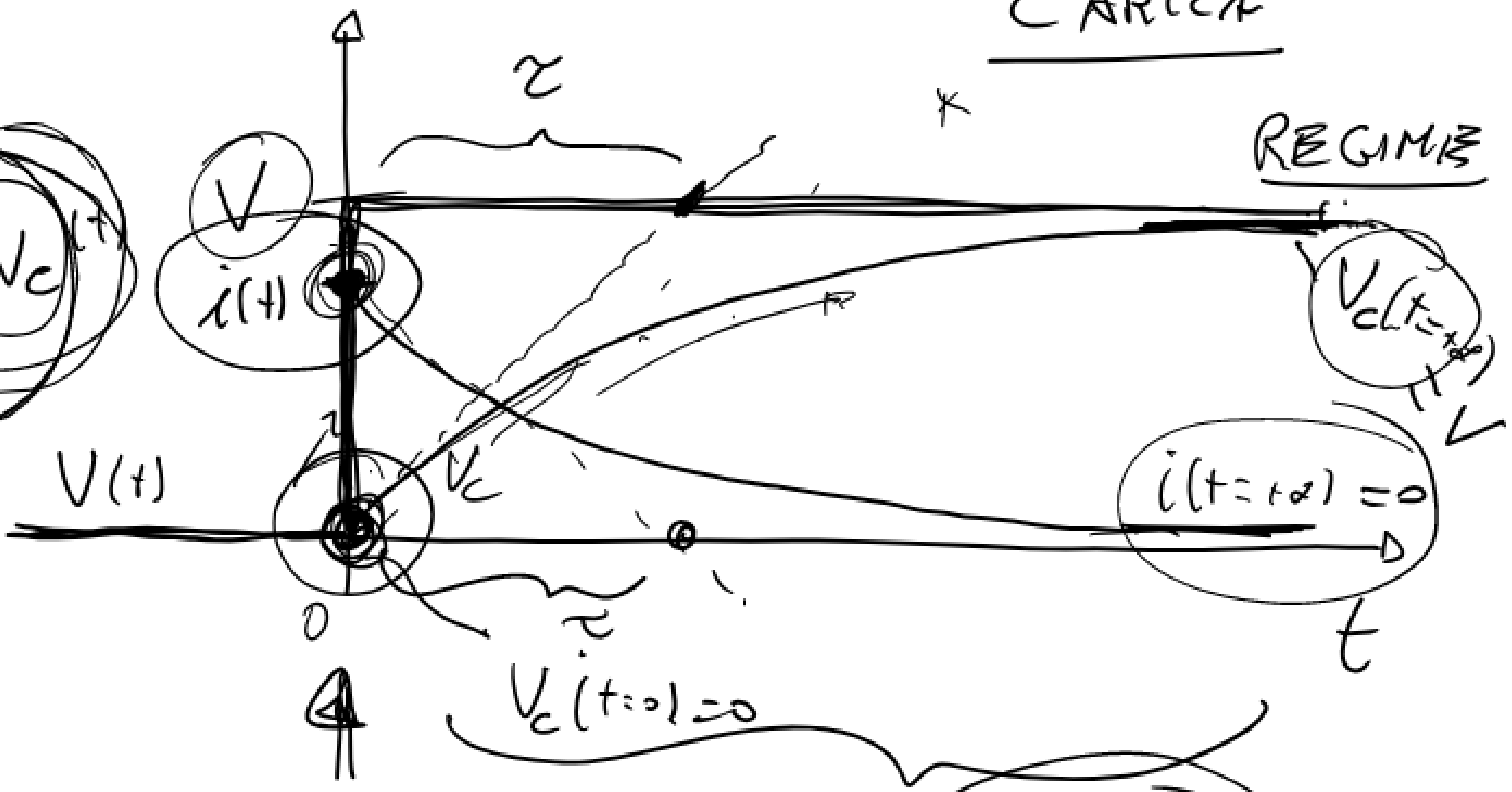
$$W = \int_0^{+\infty} P(t)\,dt = \int_0^{+\infty} V(t) \cdot i(t)\,dt = C \int_0^{+\infty} V(t) \frac{dV(t)}{\cancel{dt}} \cancel{dt} =$$

$$= C \int V\,dV = \boxed{\frac{1}{2} C \cdot V^2}$$

TRANSITORIO CONDENSATORE RC



CARICA



$$i(t) = C \cdot \frac{dV(t)}{dt}$$

$R_C = 0$

$$i(t=0) = \frac{V}{R}$$

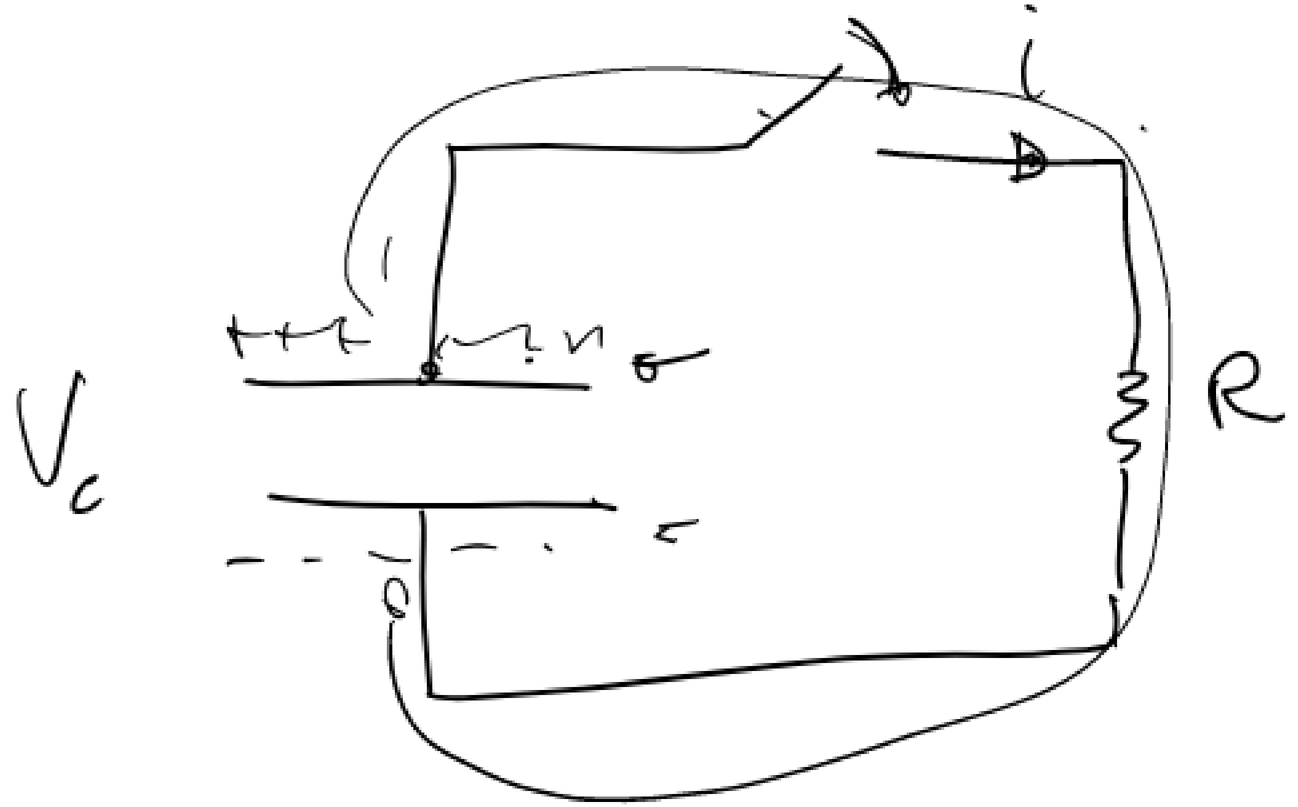
REGIME

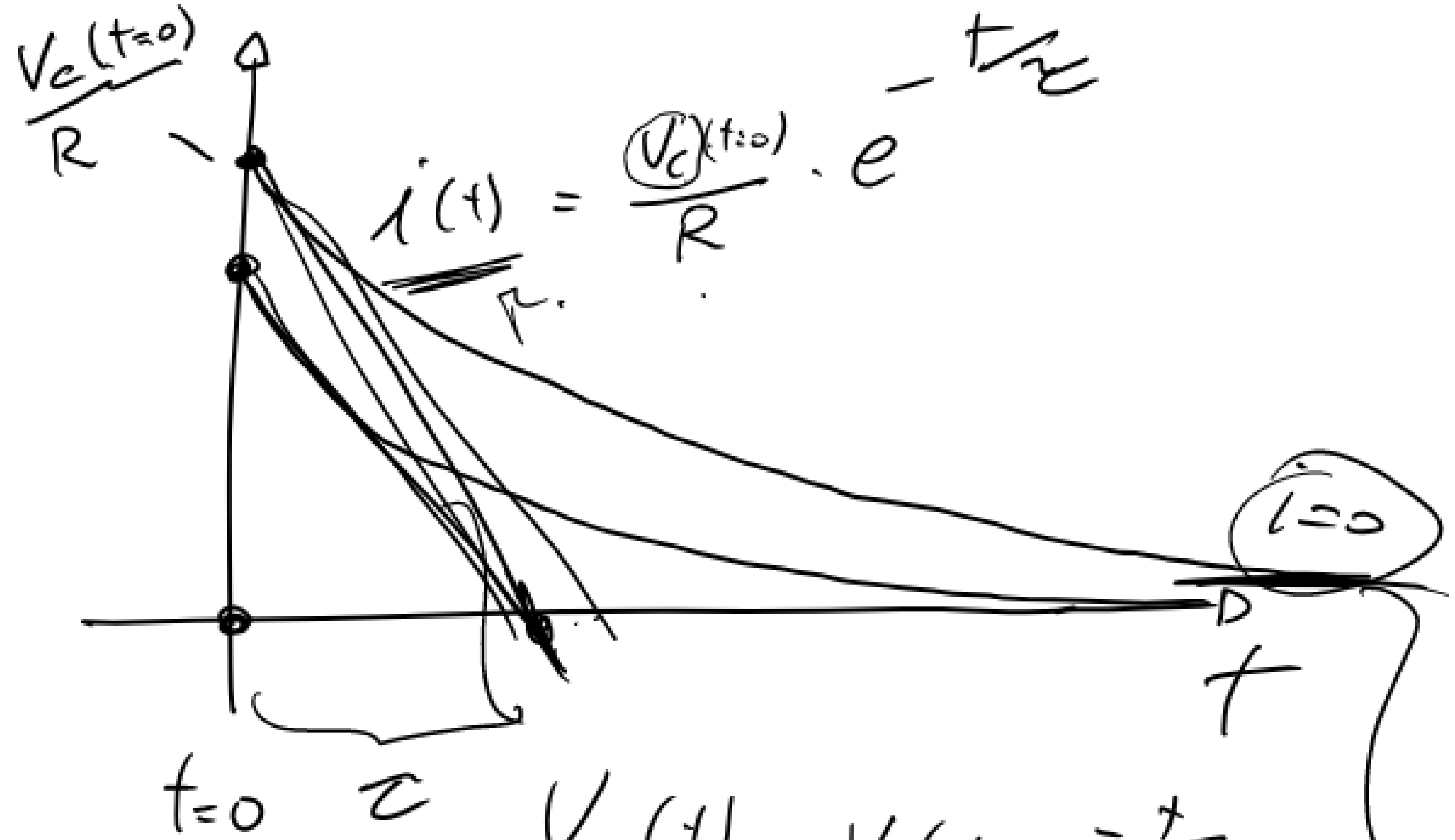
4/5 τ

$$\left.\begin{aligned} V_C(t) &= V\left(1 - e^{-t/\tau}\right) \\ i(t) &= \frac{V}{R}\, e^{-t/\tau} \end{aligned}\right\}$$

$$\boxed{\tau = R \cdot C}$$

RC SCARICA





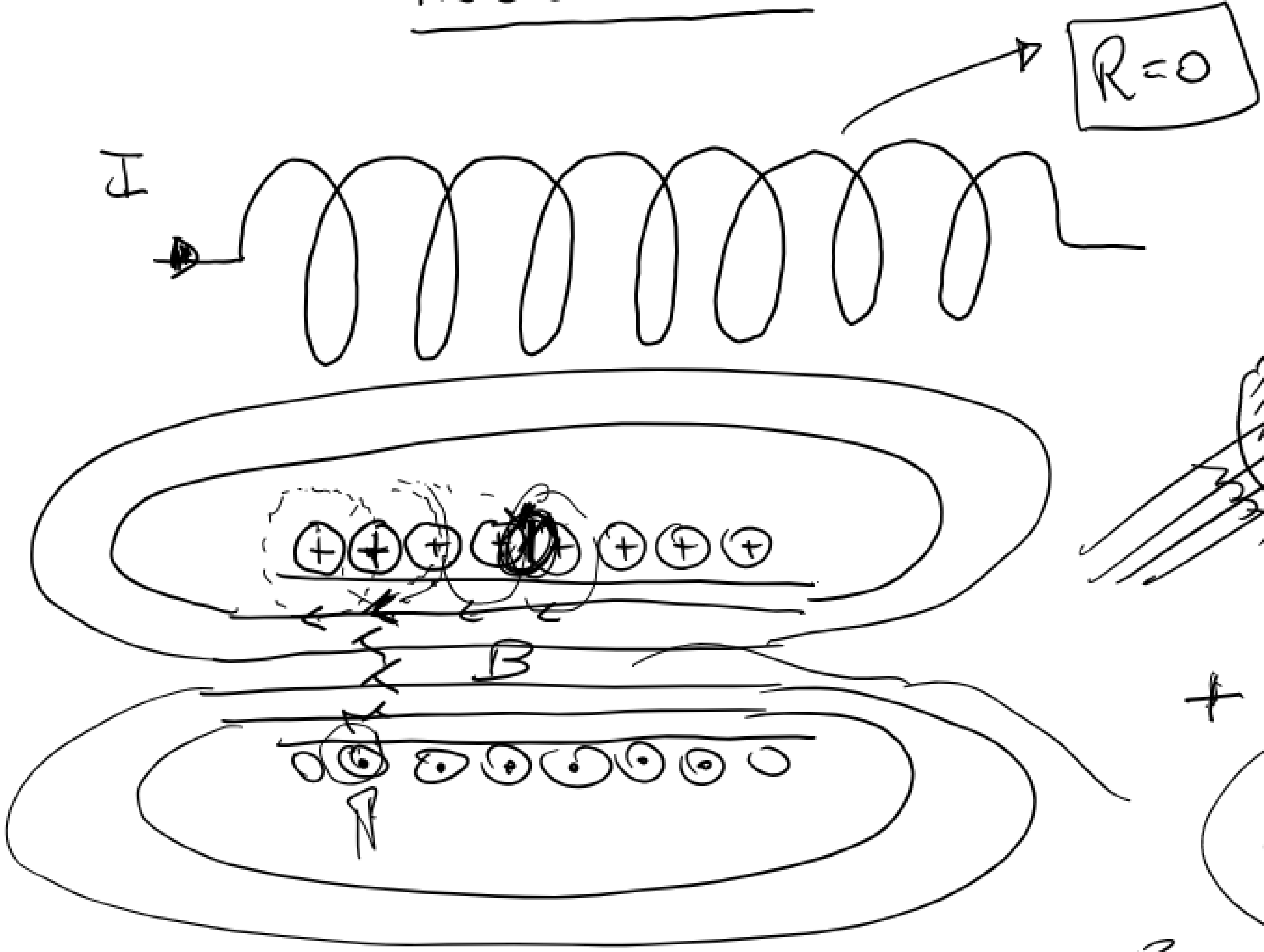
$$i(t) = \frac{V_c(t=0)}{R} \cdot e^{-t/\tau}$$

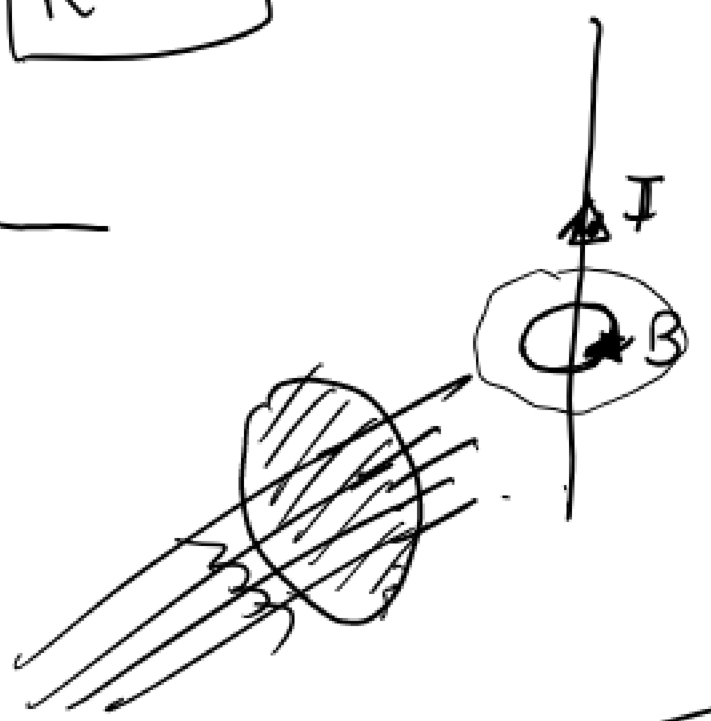
$$V_R = R \cdot i$$

$$V_c(t) = V_c(0) \cdot e^{-\frac{t}{\tau}}$$

$4/5\ \tau$

INDUTTANZA





$\vec{B} \cdot S$

$$\Phi_S(B) = \int_S \vec{B} \cdot \hat{n} \, dS$$

COEFFICIENTE DI AUTOINDUZIONE

L

Henry [H]

$$\boxed{\Phi(B) = L \cdot I}$$

$\Phi_B(t)$

$i(t)$

$i(t) \Rightarrow B(t) \Rightarrow \phi_B(t)$

LEGGE DI NEUMAN - FARADAY - LENZ

$$\boxed{e = -\frac{d\phi_B}{dt}}$$

$\phi_B = L \cdot i$

f.e.m. autoindotte

SI OPPONE ALLA VARIAZIONE

$i(t) \Rightarrow \phi_B$

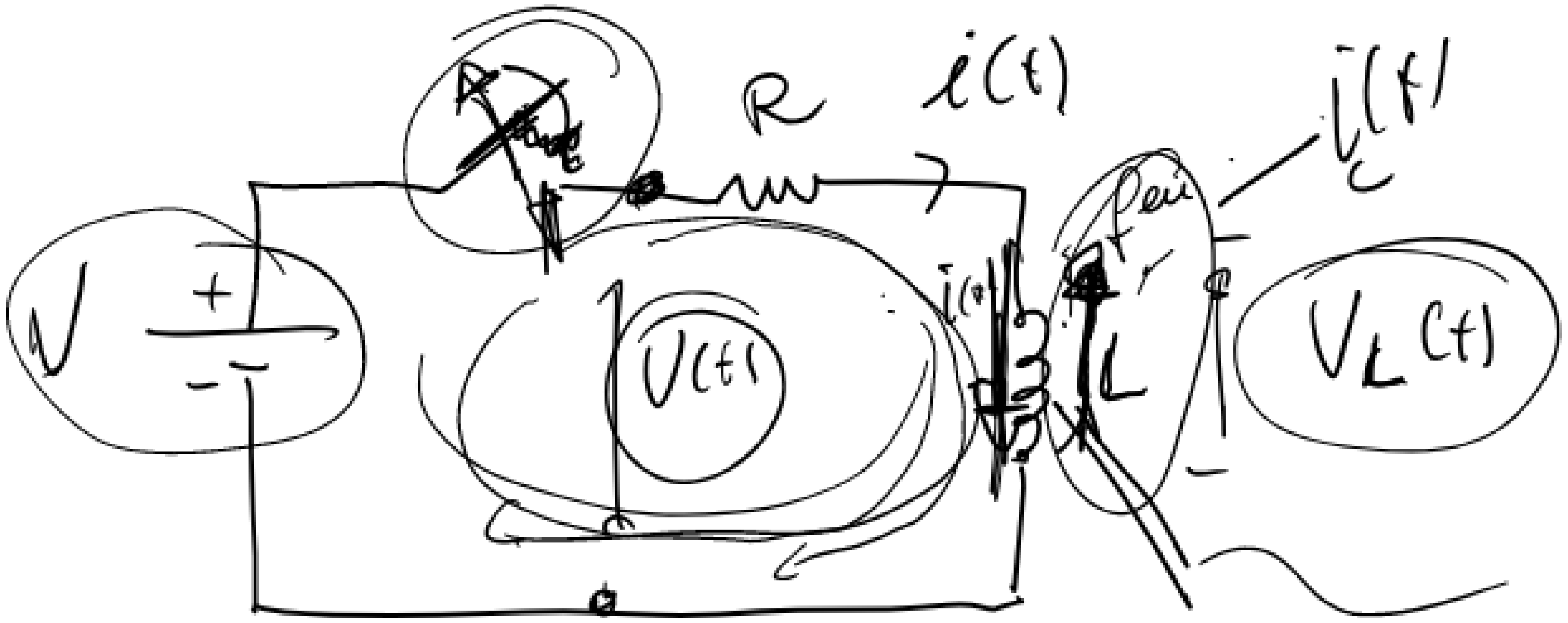
$\frac{d\phi}{dt} < 0 \Rightarrow e > 0$

$> 0 \Rightarrow e < 0$

$$\boxed{V_L(t) = -L\,\frac{di(t)}{dt}}$$

$$\left(i(t) = C \cdot \frac{dV(t)}{dt} \right)$$

TRANSITORIO RL



$$\boxed{W = \frac{1}{2} L I^2}$$

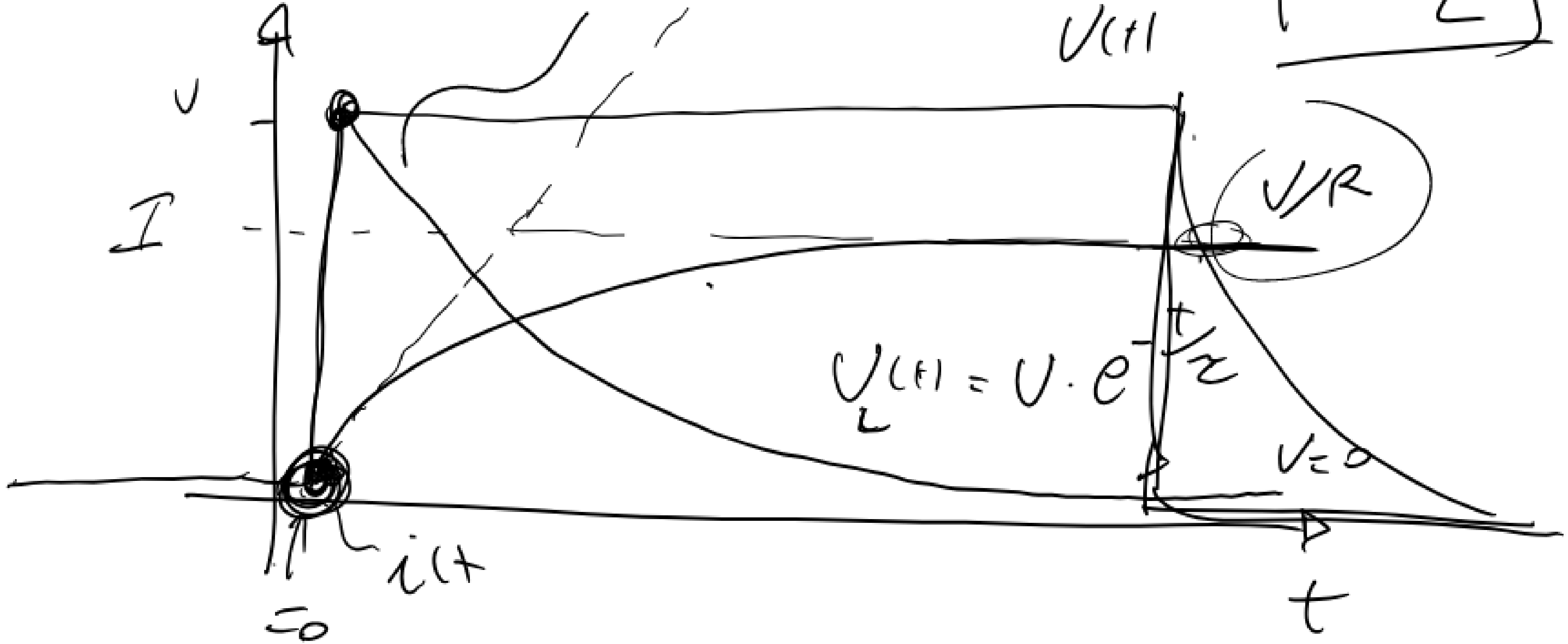
$$i(t=+\infty) = \frac{V}{R}$$

$$i(t) = \frac{V}{R}\left(1 - e^{-t/\tau}\right)$$

$$\boxed{\tau = \frac{R}{L}}$$

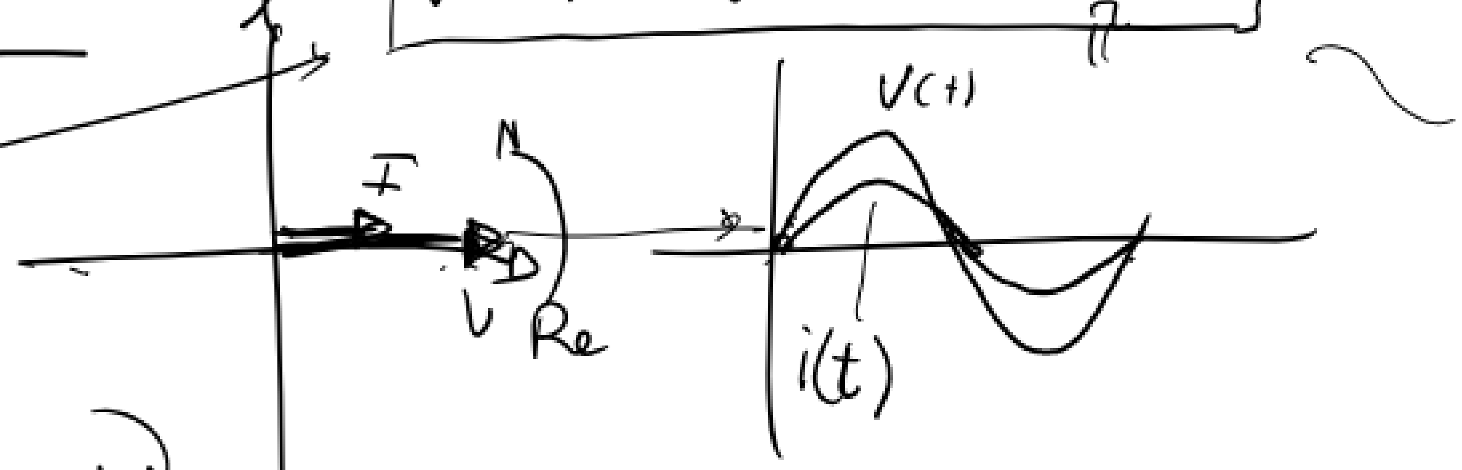
L si oppone alle variazioni

$R_L = 0$



REGIME SINUSOIDALE R, L, C

$$\boxed{V(t) = V_0 \sin(\omega t)}$$



$\boxed{R}$

$$V(t) = R \cdot i(t)$$

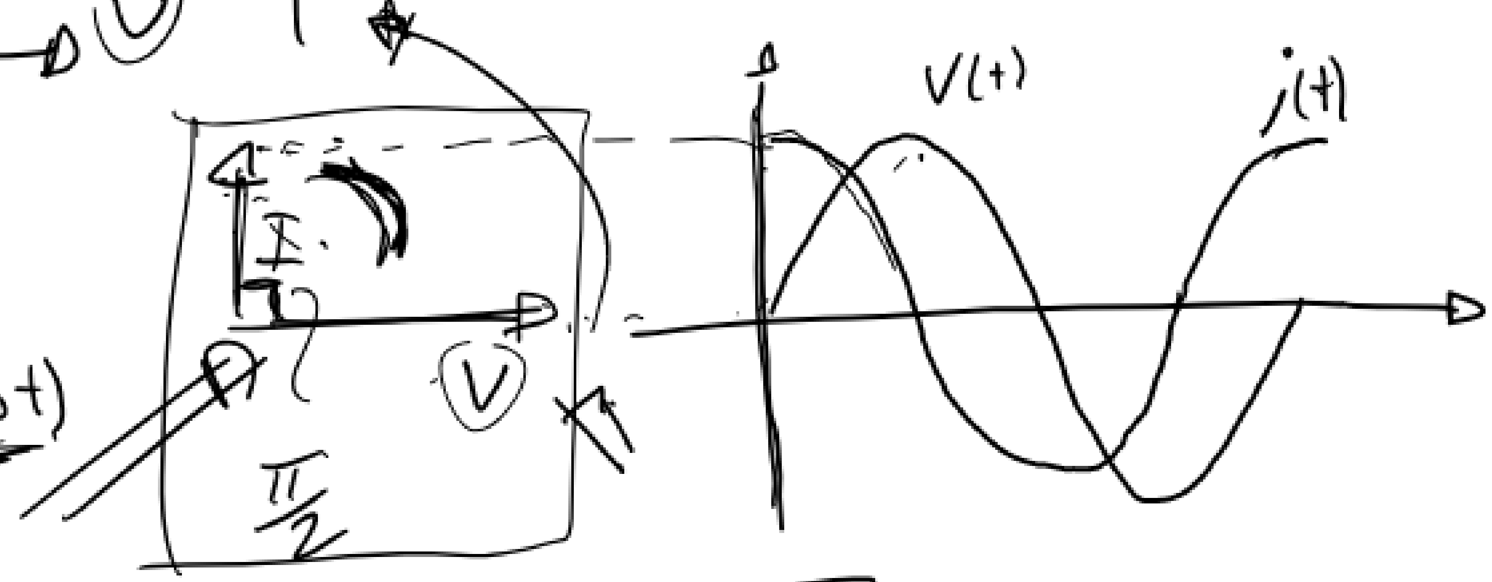
$$\boxed{i(t) = \frac{V_0}{R} \cdot \sin \omega t}$$

$$\bar{V} = V_0$$
$$\bar{I} = \frac{V_0}{R}$$

V R sono in fase

$\boxed{C}$

$$i(t) = C \cdot \frac{dV(t)}{dt} = \omega C \cdot V_0 \cdot \cos(\omega t)$$



$$\boxed{\begin{aligned} \bar{V} &= V_0 \\ \bar{I} &= j\omega C \cdot V_0 \end{aligned}}$$

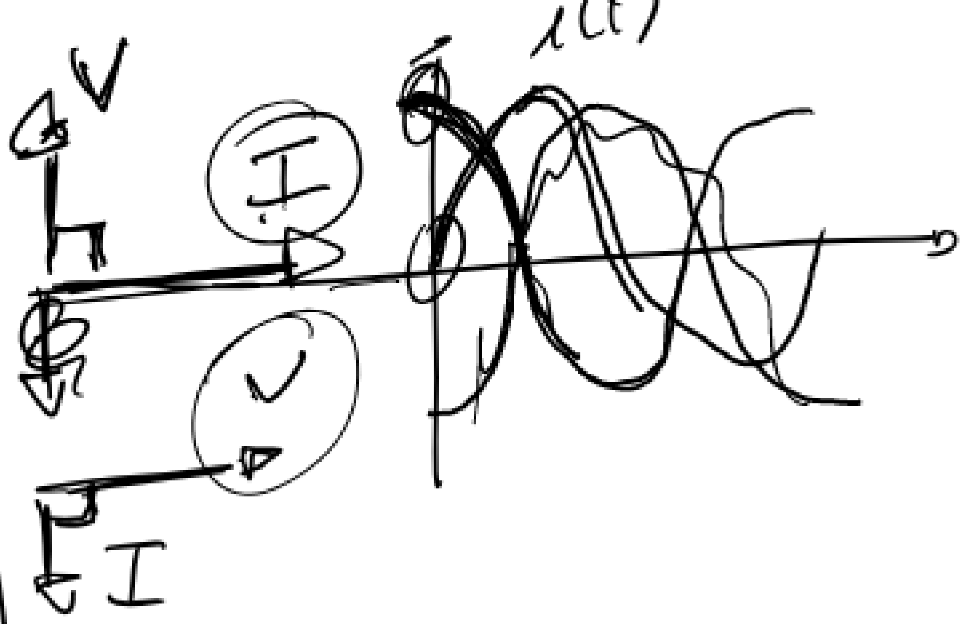
$\boxed{\bar{I} \text{ ANTICIPO DI } \frac{\pi}{2} \text{ Rispetto } V}$

SFASAM

$\boxed{L}$

$$V(t) = L \frac{di(t)}{dt}$$

$$i(t) = i_0 \sin \omega t$$
$$v(t) = +\omega L i_0 \cos \omega t$$



fenomeno induttivo

$\boxed{I \text{ RITARDO DI } \frac{\pi}{2} \text{ RISPETTO a } V}$

$\boxed{\bar{V} = \bar{Z} \cdot \bar{I}}$

IMPEDENZA

R $\quad \bar{V} = R\bar{I}$

C $\quad \bar{V} = V_0$

$\boxed{\bar{I} = j\omega C V_0}$

$\bar{I} = \boxed{\frac{1}{\bar{Z}}} \bar{V}$

$\bar{V} = \frac{\bar{I}}{j\omega C} = \bar{Z} \cdot \bar{I}$

capacit. cost.

$\boxed{\bar{Z}_C = \frac{1}{j\omega C} = -j X_C}$

X_C REATTANZA CAPACITIVA

$\boxed{X_C = \frac{1}{\omega C}}$

L

$i(t) = I_0 \sin\omega t$

$v(t) = \omega L I_0 \cos\omega t$

$\bar{I} = I_0$

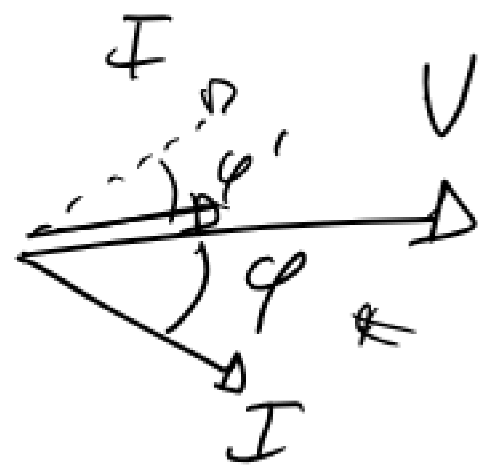
$\bar{V} = j\omega L I_0 \Rightarrow \bar{V} = \boxed{j\omega L}\,\bar{I} = \bar{Z}_L \cdot \bar{I}$

$\boxed{\bar{Z}_L = j\omega L = j X_L}$

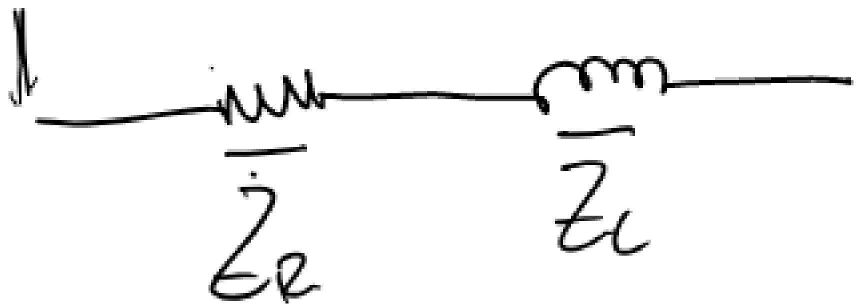
$\boxed{X_L = \omega L}$ Reattanza induttiva

impedenza puramente induttiva.

$\bar{Z}_R = R \qquad \bar{Z}_L = jX_L \qquad \bar{Z}_C = -jX_L$



R serie / parallelo



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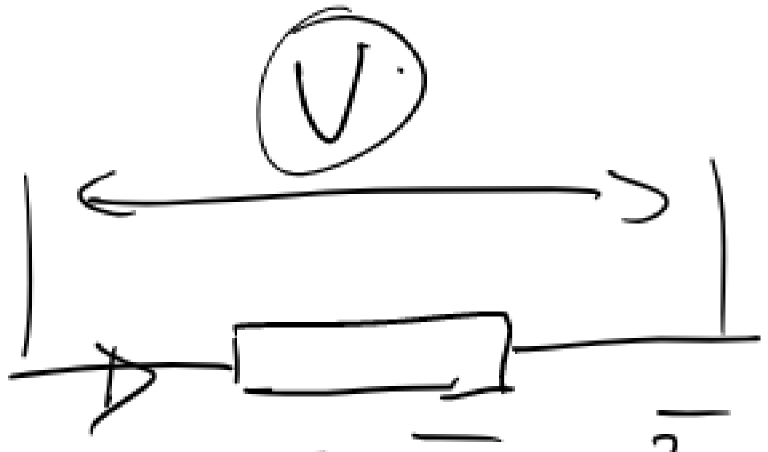
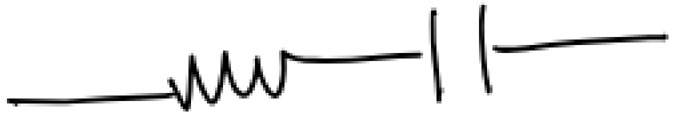


I $\quad \bar{Z} = \bar{Z}_R + \bar{Z}_L = R + jX_L$



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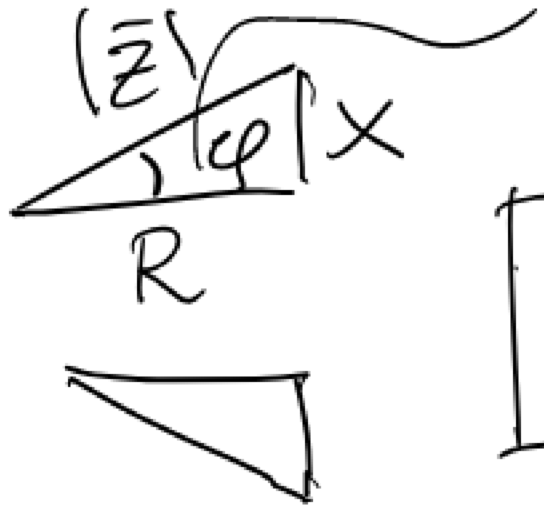
$\bar{Z} = R - jX_C$

$\bar{Z} = R + jX_L - jX_C = R + jX$

$\bar{Z} = R + jX$

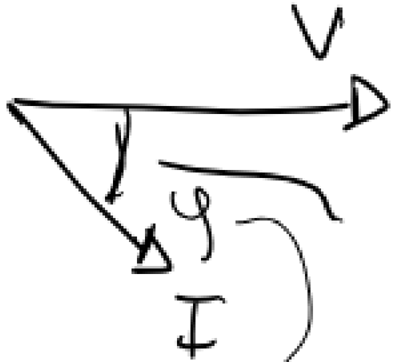
Resistenza — Reattanza



SFASAMENTO di I rispetto a V

$$\boxed{\varphi = \mathrm{arctg}\,\frac{X}{R}}$$

dato $\bar{Z} = R + jX$



$$\boxed{\varphi = \operatorname{arctg}\frac{X}{R}}$$

$\bar{V} = V_0$

$$\bar{V} = \bar{Z} \cdot \bar{I} \Rightarrow \bar{I} = \frac{\bar{V}}{\bar{Z}}$$

?

Regime sinusoidale → serie F