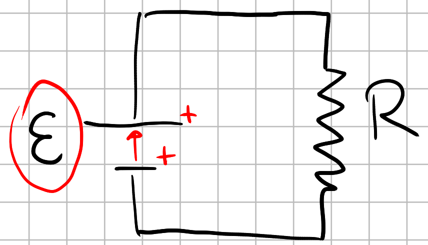
FORZA ELETTROMOTRICE



$$\Delta V = Ri = V_A - V_B = \int_A^B \vec{E} \cdot d\vec{s}$$

CAMPO ELETTROMOTORE

$$\oint \vec{E} \cdot d\vec{s} = Ri \neq 0 \quad , \quad \vec{E} = \vec{E}_{el} + \vec{E}_{em}$$

$$\oint \underbrace{\cancel{\vec{E}_{el} \cdot d\vec{s}}}_{=0} + \underbrace{\oint \vec{E}_{em} \cdot d\vec{s}}_{= \mathcal{E}} = Ri$$

$\mathcal{E}$ FORZA ELETTROMOTRICE

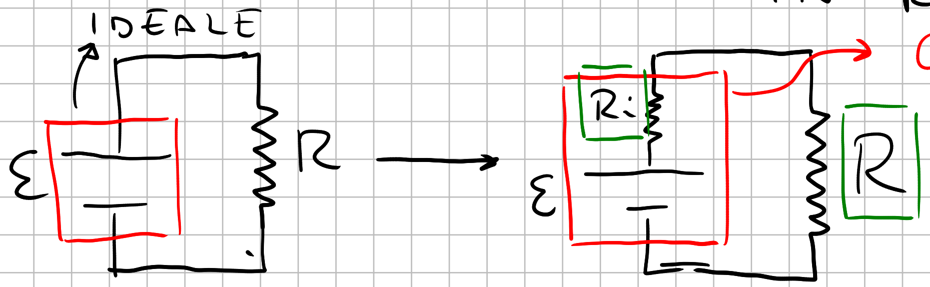
$[\mathcal{E}] = V$ Volt

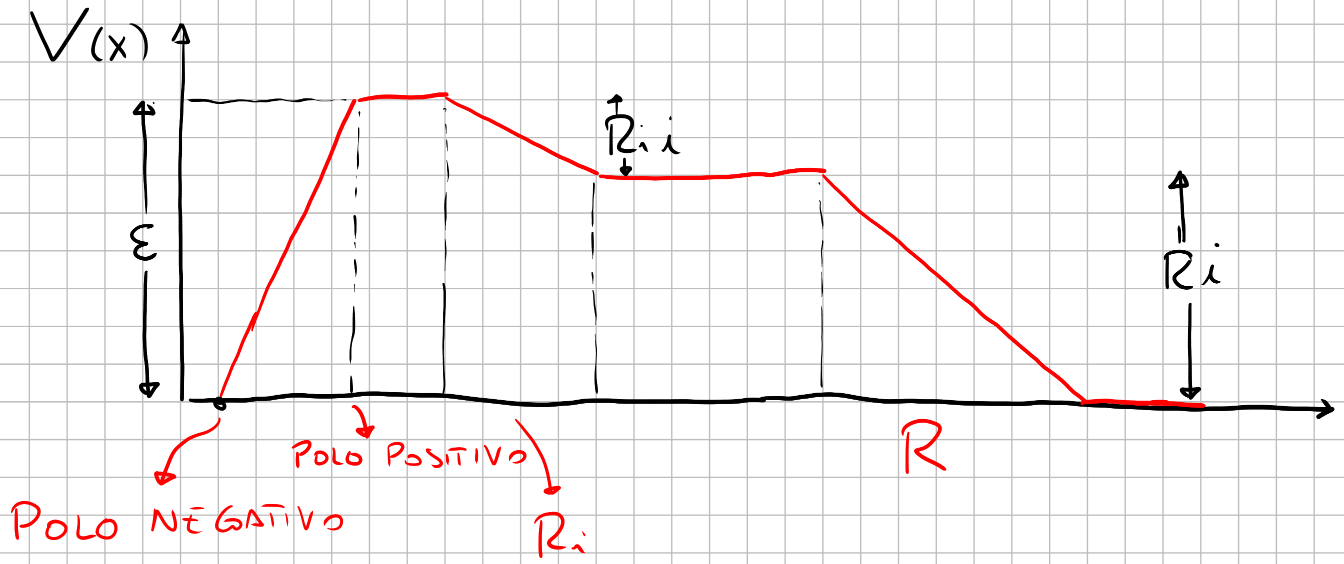
$\Delta V = Ri$ legge di Ohm

$\downarrow$

$\mathcal{E} = Ri$ in presenza di generatori

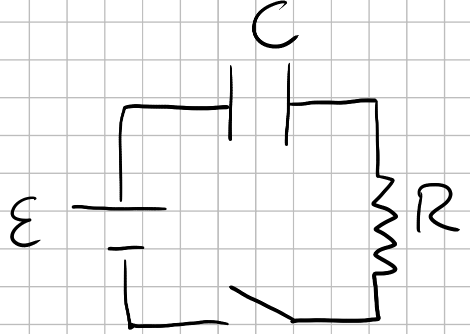
INTERPRETAZIONE FISICA





$$\boxed{U_e = q_0 V}$$

CIRCUITO RC



$$\Delta V_c = \frac{q}{C}\ ,\quad \Delta V_R = Ri\ ,\quad \mathcal{E}$$

$$\mathcal{E} = \Delta V_c + \Delta V_R = \frac{q}{C} + Ri = \frac{q}{C} + R\frac{dq}{dt} \Rightarrow$$

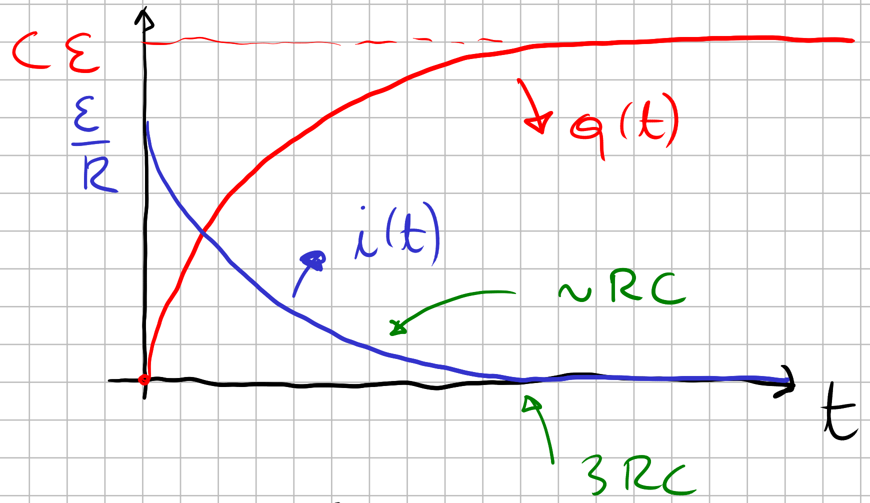
$$R\frac{dq}{dt} = \mathcal{E} - \frac{q}{C} \Rightarrow \frac{dq}{C\mathcal{E} - q} = \frac{dt}{RC} \Rightarrow \frac{dq}{q - C\mathcal{E}} = -\frac{dt}{RC} \Rightarrow$$

$$\int_0^{q(t)} \frac{dq'}{q' - C\mathcal{E}} = \int_0^t -\frac{dt}{RC} = -\frac{t}{RC} \Rightarrow \int_0^{q(t)} \frac{dq'}{q'-C\mathcal{E}} = \log(q' - C\mathcal{E})\Big|_0^{q(t)} = \log(q(t) - C\mathcal{E}) - \log(-C\mathcal{E})$$

$$\Rightarrow \log\left[\frac{q(t) - C\mathcal{E}}{-C\mathcal{E}}\right] = -\frac{t}{RC} \Rightarrow \frac{q(t) - C\mathcal{E}}{-C\mathcal{E}} = e^{-\frac{t}{RC}} \Rightarrow$$

$$q(t) = C\mathcal{E}\left(1 - e^{-\frac{t}{RC}}\right)$$

$$q(t) = C\mathcal{E}\left(1 - e^{-\frac{t}{RC}}\right), \quad i(t) = \frac{\mathcal{E}}{R} e^{-\frac{t}{RC}}, \quad \Delta V_c = \mathcal{E}\left(1 - e^{-\frac{t}{RC}}\right)$$



$$e^{-\frac{t}{RC}}$$

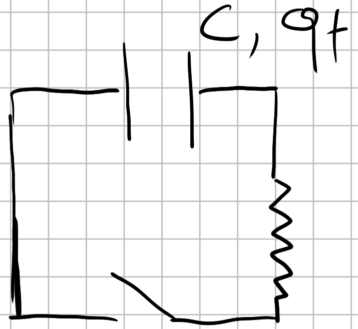
$[RC] = s$

RC TEMPO CARATTERISTICO

$RC = \tau$

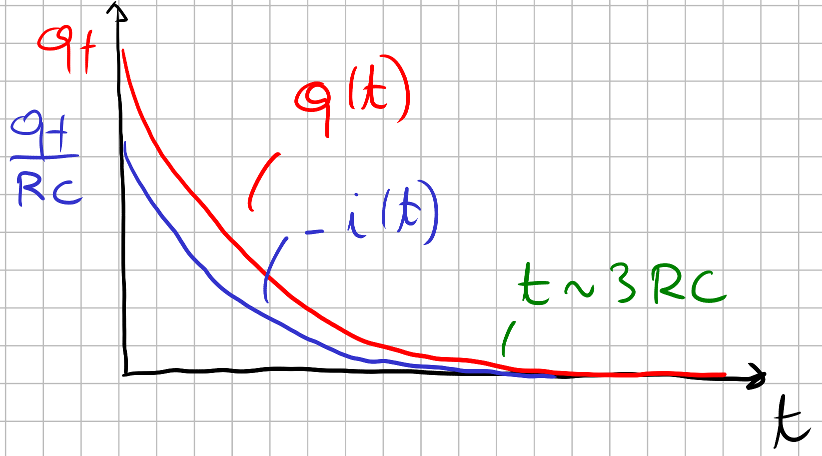
$$W = \int_0^{C\mathcal{E}} \mathcal{E}\, dq = \mathcal{E}^2 C, \quad U_e^{(c)} = \frac{1}{2}\mathcal{E}^2 C, \quad W - U_e^{(c)} = \frac{1}{2}\mathcal{E}^2 C$$

SCARICA DI UN CONDENSATORE



$$\Delta V_R + \Delta V_C = 0 \Rightarrow Ri + \frac{q}{C} = R\frac{dq}{dt} + \frac{q}{C} = 0 \Rightarrow$$

$$\frac{dq}{q} = -\frac{dt}{RC} \Rightarrow q(t) = \underline{q_f}\, e^{-\frac{t}{RC}}, \quad i(t) = -\frac{q_f}{RC} e^{-\frac{t}{RC}}$$



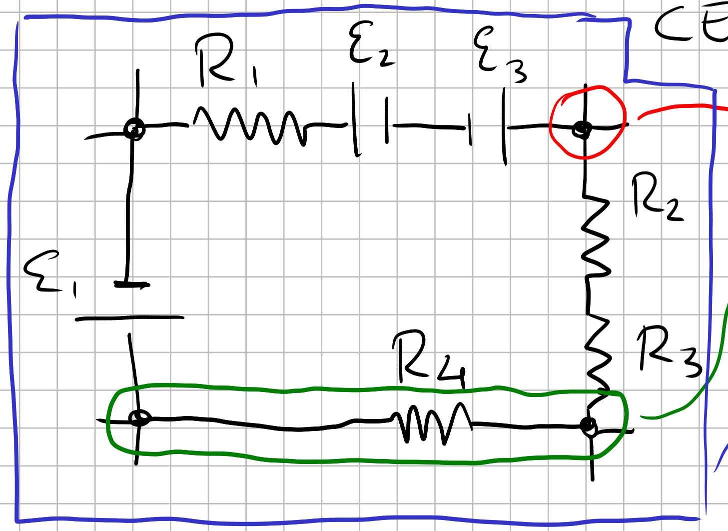
all'inizio $U_e^{(i)} = \frac{1}{2}\frac{q_f^2}{C}$, ma $U_e^{(f)} = 0$

$$P_R = Ri^2 = \frac{\cancel{R}\, q_f^2}{R^{\cancel{2}} C^2} e^{-2\frac{t}{RC}} \Rightarrow$$

$$W_R = \int_0^\infty \frac{q_f^2}{RC^2} e^{-\frac{2t}{RC}}\, dt = -\frac{q_f^2\, \cancel{RC}}{2\cancel{R}C^{\cancel{2}}} e^{-\frac{2t}{RC}}\Big|_0^\infty =$$

$$= \frac{1}{2}\frac{q_f^2}{C}$$

CENNI SULLE RETI ELETTRICHE

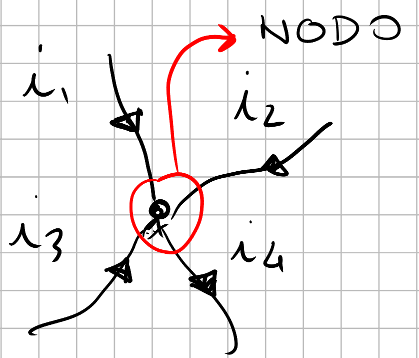


NODO DELLA RETE

RAMO DELLA RETE

MAGLIA DELLA RETE

I LEGGE DI KIRCHHOFF

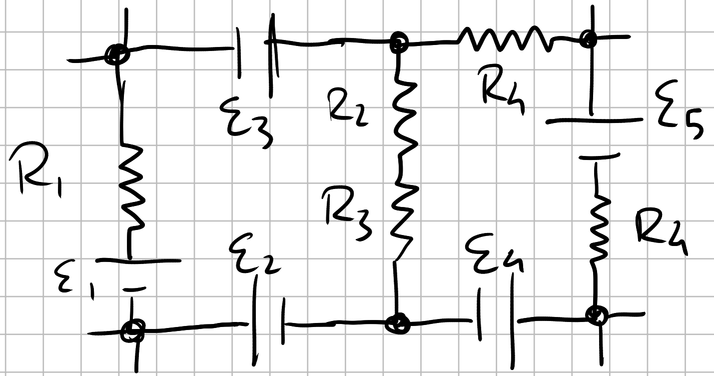


$$\sum_{k=1}^{N} i_k = 0$$

ATTENZIONE: le correnti devono avere il segno appropriato!

II LEGGE DI KIRCHHOFF

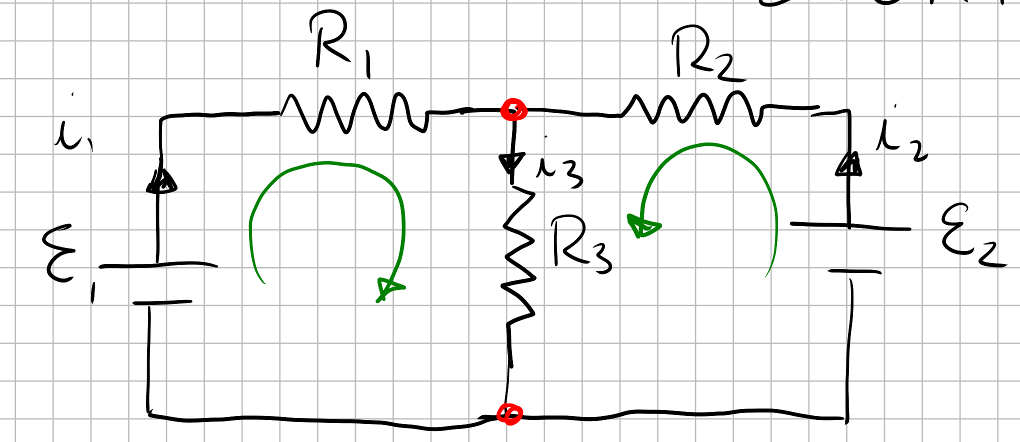
SI APPLICA ALLE MAGLIE



1) scegliete una maglia composta da N rami
2) scegliete un verso di percorrenza
3) vale

$$\sum_{k=1}^{N} \mathcal{E}_k = \sum_{k=1}^{N} R_k i_k$$

ESEMPIO



$\mathcal{E}_1 = 10\,V, \quad \mathcal{E}_2 = 20\,V$

$R_1 = 10\,\Omega, \; R_2 = 20\,\Omega, \; R_3 = 40\,\Omega$

$$\begin{cases} i_1 + i_2 - i_3 = 0 \\ -i_1 - i_2 + i_3 = 0 \end{cases}$$ I LEGGE

$$\begin{cases} +\mathcal{E}_1 = R_1 i_1 + R_3 i_3 \\ +\mathcal{E}_2 = R_2 i_2 + R_3 i_3 \end{cases}$$ II LEGGE

$i_1 = -0.143\,A, \quad i_2 = 0.429\,A, \quad i_3 = 0.286\,A$