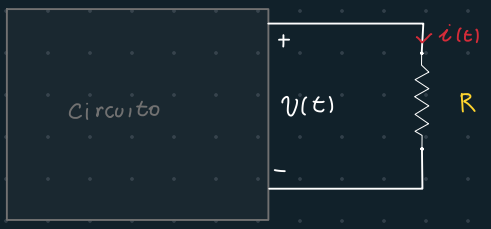


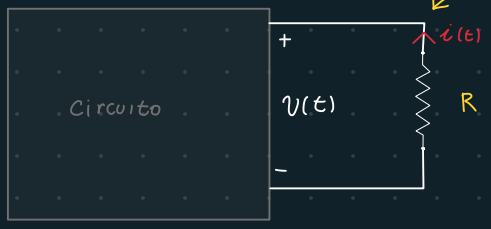
Conv. Utilizzatore

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

$P_a(t) = v(t) \cdot i(t)$

$P_a(t) = R\, i^2(t) \geq 0$ → Il resistore non ha mai potenza assorbita minore di zero!

Se $R > 0$



generatore

$v(t) = - R \cdot i(t)$

ma $P_e(t) = v(t) \cdot i(t) = - R\, i^2(t) \leq 0 \quad \forall i(t)$

Resistenza sempre > 0

Inoltre so che

- $v(t) = R \cdot i(t) \Rightarrow i(t) = \frac{v(t)}{R} = G \cdot v(t) \rightarrow P_a(t) = v^2(t) \cdot G \geq 0$ Utilizzatore

  (G: conduttanza)

- $v(t) = - R \cdot i(t) \Rightarrow i(t) = - \frac{v(t)}{R} = - G \cdot v(t) \rightarrow P_e(t) = - v^2(t) \cdot G \leq 0$ Generatore

Energia Assorbita

$$U_a(t, t_0) = \int_{t_0}^{t} P_a(\tau)\, d\tau$$

$$U_a(t, t_0) = \int_{t_0}^{t} R \cdot i^2(\tau)\, d\tau \geq 0$$ Energia Assorbita

Corto circuito

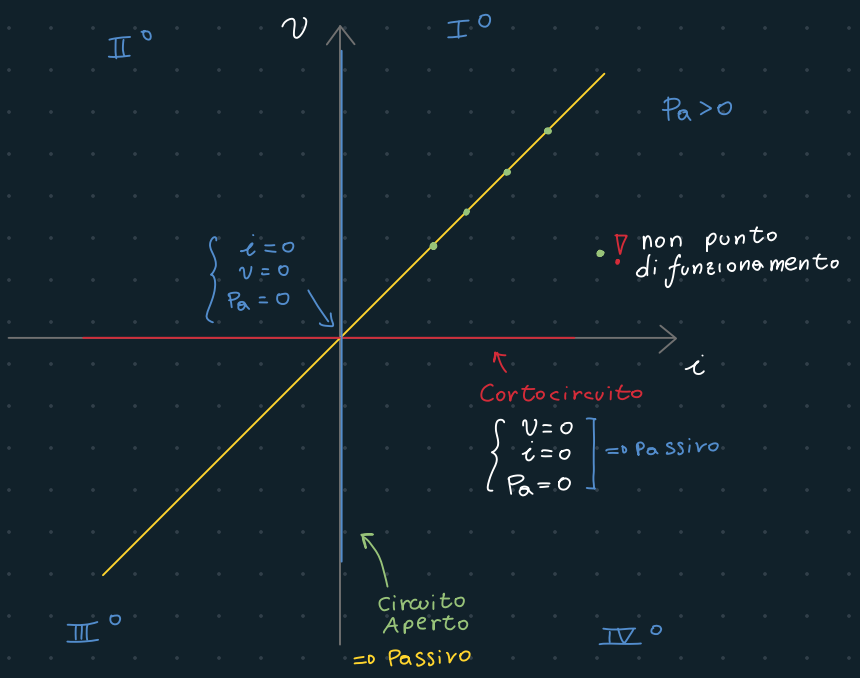
$$R = 0 \Rightarrow \begin{cases} P_a(t) = 0 \\ P_e(t) = 0 \end{cases} \Rightarrow \begin{cases} U_a(t, t_0) = 0 \\ U_e(t, t_0) = 0 \end{cases}$$

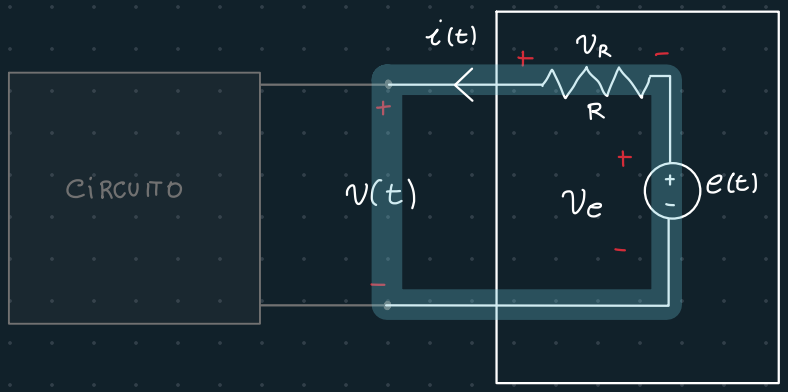
Circuito Aperto

$$G = 0 \Rightarrow \begin{cases} P_a(t) = 0 \\ P_e(t) = 0 \end{cases} \Rightarrow \begin{cases} U_a(t, t_0) = 0 \\ U_e(t, t_0) = 0 \end{cases}$$

$(R \to +\infty)$

Bipolo passivo • convenzione utilizzatore





Generatore Reale

Senso ORARIO

LKT: $-v(t) - v_R(t) + v_e(t) = \emptyset$

Equazioni Caratteristiche

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

$v_e(t) = i(t)$

$$\begin{cases} -v(t) - v_R(t) + v_e(t) = \emptyset \\ v_R(t) = R \cdot i(t) \\ v_e(t) = i(t) \end{cases} \longrightarrow -v(t) - R \cdot i(t) + i(t)$$

$$\longrightarrow v(t) = i(t) - R\, i(t)$$

Caratteristica del generatore Reale

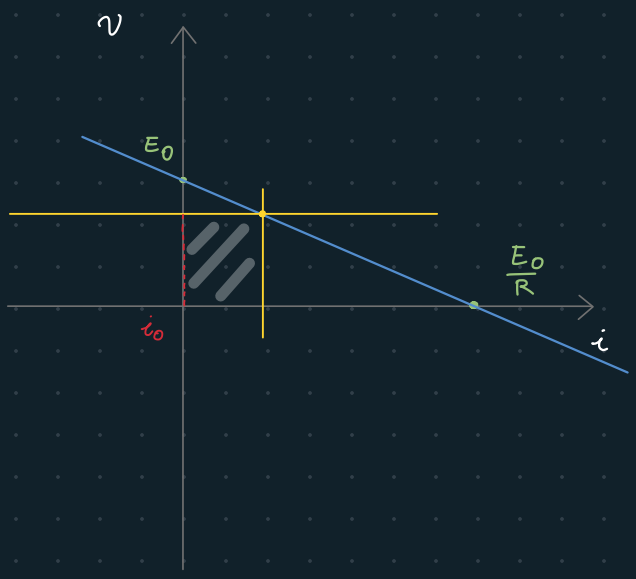
Esempio di applicazione — Batteria

Hp: Se $e(t) = \underbrace{\text{Cost} = E_0 > 0}_{\text{Esempio}}$ $\rightarrow$ $V = E_0 - R \cdot i$ RETTA

↓

Per tracciarla ci bastano 2 punti!

Conv. generatore



$= 0$ $\begin{cases} i = 0 \rightarrow V = E_0 & \text{Tensione a vuoto} \\ V = 0 \rightarrow i = \frac{E_0}{R} & \text{Corrente di Cortocircuito} \end{cases}$

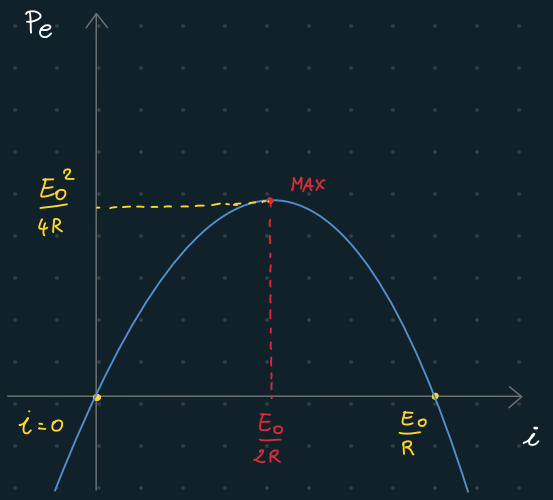
ESEMPIO PRATICO

$E_0 = 1.4\ V$, $R = 10\ m\Omega$ $\Big\}$ $\frac{E_0}{R} = 140\ A$

POTENZA MASSIMA

$P_e = V \cdot i = (E_0 - Ri)\, i = E_0 i - R i^2 \rightsquigarrow \underbrace{P_e(i) = E_0 i - R i^2}_{\text{PARABOLA}}$

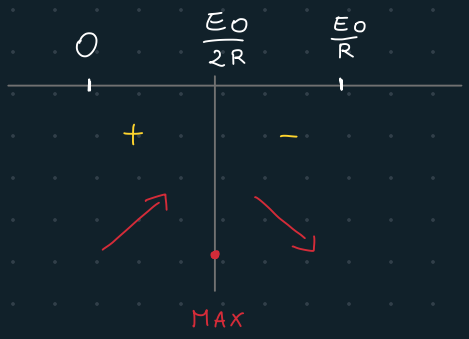
Costanti — $V = E_0 - Ri$



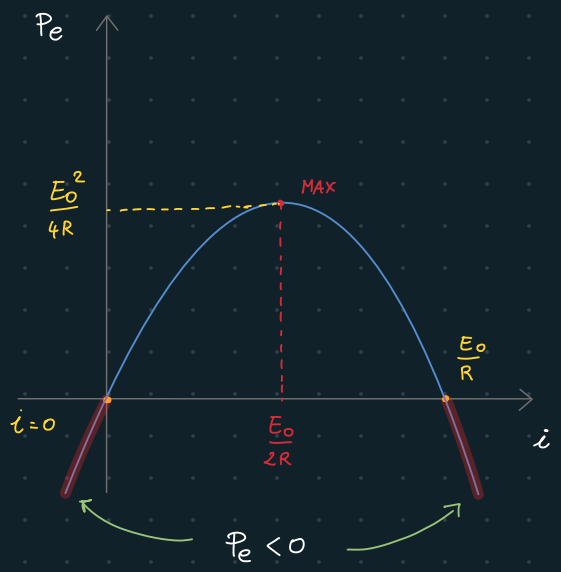
$P_e'(i) = E_0 - 2Ri$

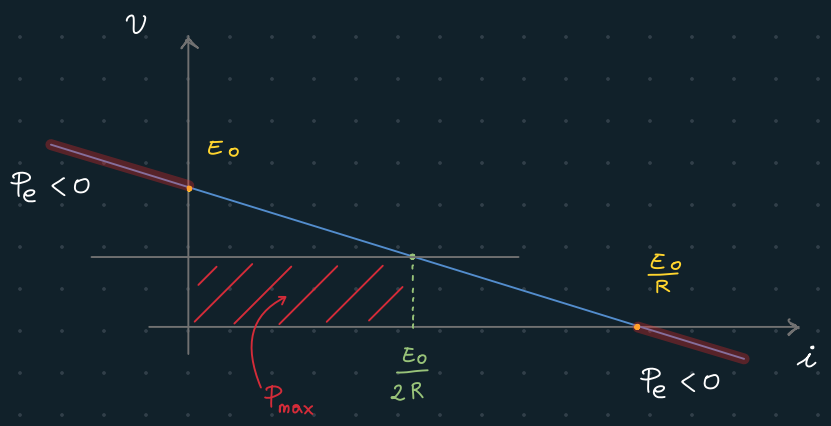
$\rightarrow P_e'(i) > 0 \rightarrow E_0 - 2Ri > 0$

per $i < \frac{E_0}{2R}$



$P_{max} = P\left(\underbrace{\frac{E_0}{2R}}_{i_{max}}\right) = E_0 \cdot \frac{E_0}{2R} - R\,\frac{E_0^2}{4R^2} = \frac{E_0^2}{2R} - \frac{E_0^2}{4R} = \frac{2E_0^2 - E_0^2}{4R} = \boxed{\frac{E_0^2}{4R}}$ Potenza Max



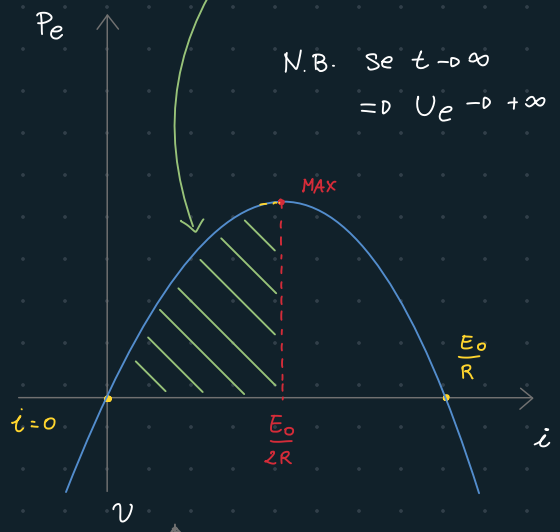


Energia Erogata

$$U_e(t, t_0) = \int_{t_0}^{t} P_e(\tau)\, d\tau \gtreqless 0$$

↑ Dipende da Corrente e Tensione

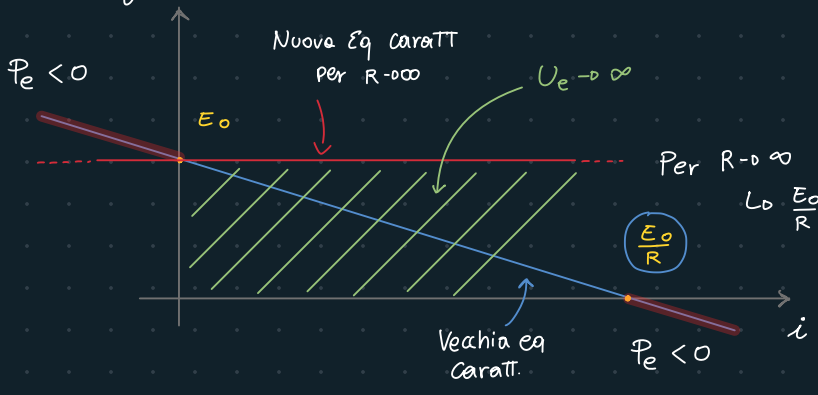
Se $\begin{cases} e(t) = 0 \\ i(t) = \begin{cases} i_0 > 0 \\ i_0 < \frac{E_0}{2R} \end{cases} \end{cases} \Rightarrow U_e > 0$



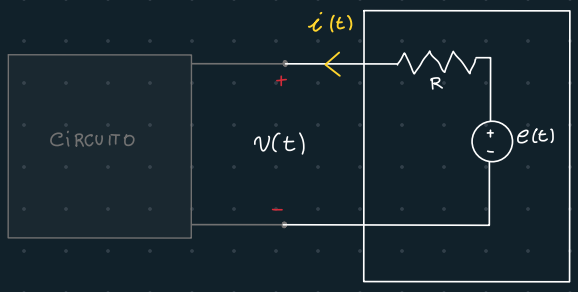
N.B. Se $t \to \infty$ $\Rightarrow U_e \to +\infty$

$V_0 = E_0 \Rightarrow P_e = E_0 \cdot i \gtreqless 0$

Se $i_0 \to 0^{\infty} \Rightarrow P_e \to 0^{\infty}$

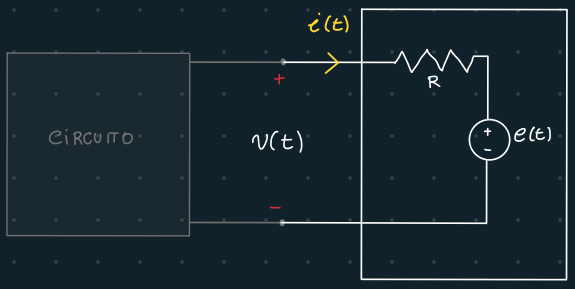


Convenzione Generatore

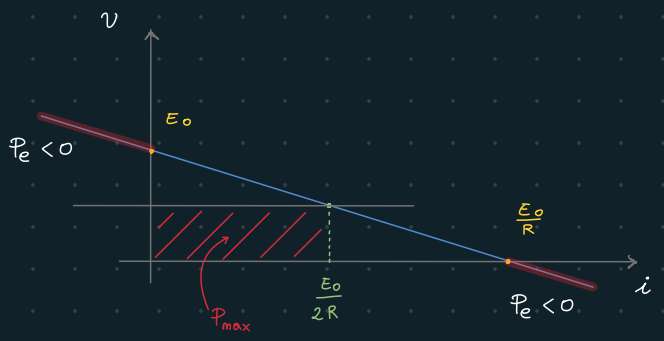


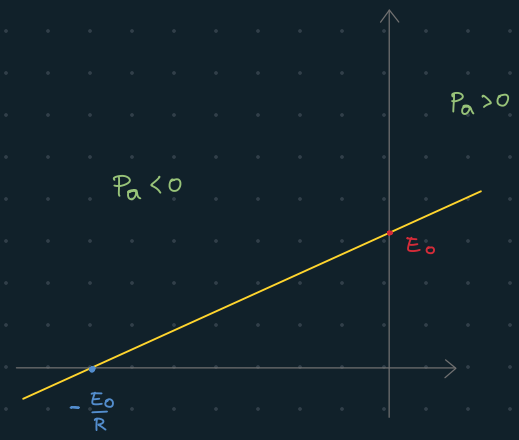
$v(t) = e(t) - R\,i(t)$ — Generatore Reale

Convenzione Utilizzatore

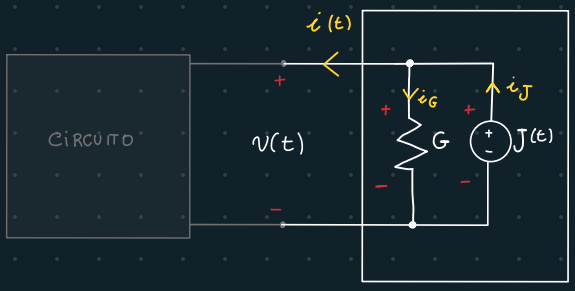


$v(t) = e(t) + R\,i(t)$ — Generatore Reale





Convenzione Generatore



Generatore Reale

LKC: $i(t) + i_G(t) - i_J(t) = 0$

LKT: Le Leggi di K. per le Tensioni ci riveleranno che le Tensioni sono Tutte uguali perchè siamo in PARALLELO

Relazioni caratteristiche, Utilizzatore

$$\begin{cases} i_G(t) = G \cdot v(t) & \text{Conduttanza} \\ i_J(t) = J(t) = I_0 & \text{Hp: Cost} \end{cases}$$

Unisco

$$\begin{cases} \text{LKT} \\ \text{LKC} \\ \text{R.C} \end{cases} \rightarrow \boxed{i(t) = I_0 - G \cdot v(t)}$$

CARATTERISTICA Generatore Corrente Reale

$$\boxed{i(t) = I_0 - G \cdot v(t)}$$ Generatore

$$\boxed{i(t) = I_0 + G \cdot v(t)}$$ Utilizzatore

P_{max} → limitata

Se $G = 0$ ⇒ $P_{max} \to \infty$