Circuiti RC

Scarica

$$\cancel{V_0} - R i(t) - \frac{q(t)}{C} = 0$$

$$-RC\frac{dq(t)}{dt} = q(t)$$

$$\frac{dq(t)}{q(t)} = -\frac{dt}{RC}$$

$$\int \frac{dq(t)}{q(t)} = -\int \frac{dt}{RC}$$

$$\ln q(t) = -\frac{t}{RC} + K \qquad RC \rightarrow \tau$$

$$q(t) = e^{-t/\tau + K}$$

$$q(0) = e^{K} = q_0$$

$$q(t) = e^{-t/\tau} \cdot q_0$$

$$i(t) = -q_0 \frac{1}{\tau} e^{-t/\tau} =$$

$$= -\frac{q_0}{RC} e^{-t/\tau} = \quad V_0$$

$$= -\frac{V_0}{R} e^{-t/\tau}$$

Energia imm. in solenoide

$$E = \frac{1}{2} L i^2$$

$$W = \vec{F} \cdot \vec{s}$$

$$W = \int F \cdot ds$$

$$dW = -dq\,V = -dq\left(-L\frac{di}{dt}\right) =$$

$$= L\frac{dq}{dt}di = Li\,di$$

$$\int_0^I dW = \int_0^I Li\,di$$

$$W = L\left[\frac{i^2}{2}\right]_0^I = L\frac{I^2}{2}$$

Circuito RL

chiusura

$$V_0 - Ri - L\frac{di}{dt} = 0$$

$$V_0 - Ri = L\frac{di}{dt}$$

$$\frac{di}{V_0 - Ri} = \frac{dt}{L}$$

$$-\frac{1}{R}\int \frac{-R\,di}{V_0 - Ri} = \int \frac{dt}{L}$$

$$-\frac{1}{R}\ln(V_0 - Ri) = t/L$$

$$\ln(V_0 - Ri) = -\frac{R}{L}t + k$$

$$V_0 - Ri = e^{-t/\tau + k}$$

$$i = \frac{V_0}{R} - \frac{e^{-t/\tau + k}}{R}$$

$$i(0) = \frac{V_0}{R} - \frac{e^k}{R} = 0$$

$$e^k = V_0$$

$$i(t) = \frac{V_0}{R} - \frac{V_0}{R} e^{-t/\tau} =$$

$$= \frac{V_0}{R}\left(1 - e^{-t/\tau}\right)$$

Apertura

$$-Ri - L\frac{di}{dt} =$$

$$-Ri = L\frac{di}{dt}$$

$$-\frac{di}{Ri} = \frac{dt}{L}$$

$$\frac{di}{i} = -\frac{R}{L}dt$$

$$\int \frac{di}{i} = -\frac{R}{L}\int dt$$

$$\ln i(t) = -\frac{R}{L}t + k$$

$$i(t) = e^{-t/\tau + k}$$

$$i(0) = e^{k} = I_0$$

$$i(t) = I_0 e^{-t/\tau}$$

$$\int \frac{f'(x)}{f(x)}\,dx = \ln|f(x)| + k$$