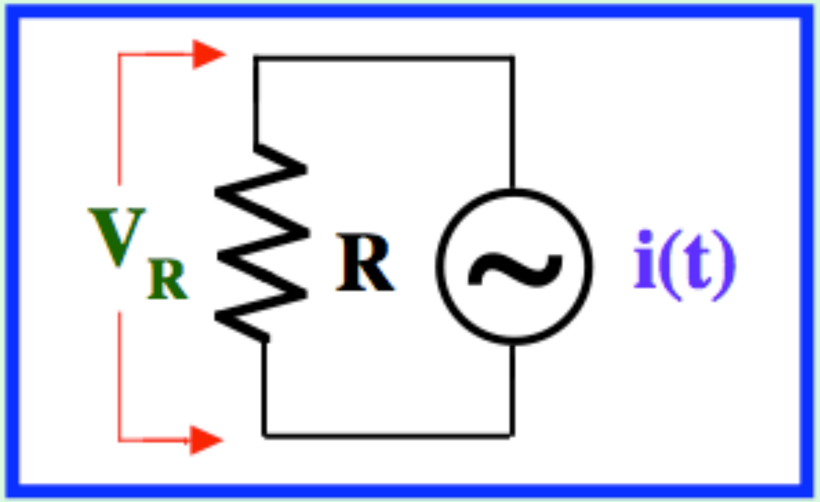
CIRCUITI IN CORRENTE ALTERNATA

i(t) → V(t)

- circuiti resistivi V_R
- circuiti induttivi V_L
- circuiti capacitivi V_C
- circuiti RLC

CIRCUITI IN CORRENTE ALTERNATA

circuito resistivo R



$$i(t) = I_0 \ \mathrm{sen}(\omega t) \rightarrow V(t) = V_0 \ \mathrm{sen}(\omega t + \phi')$$

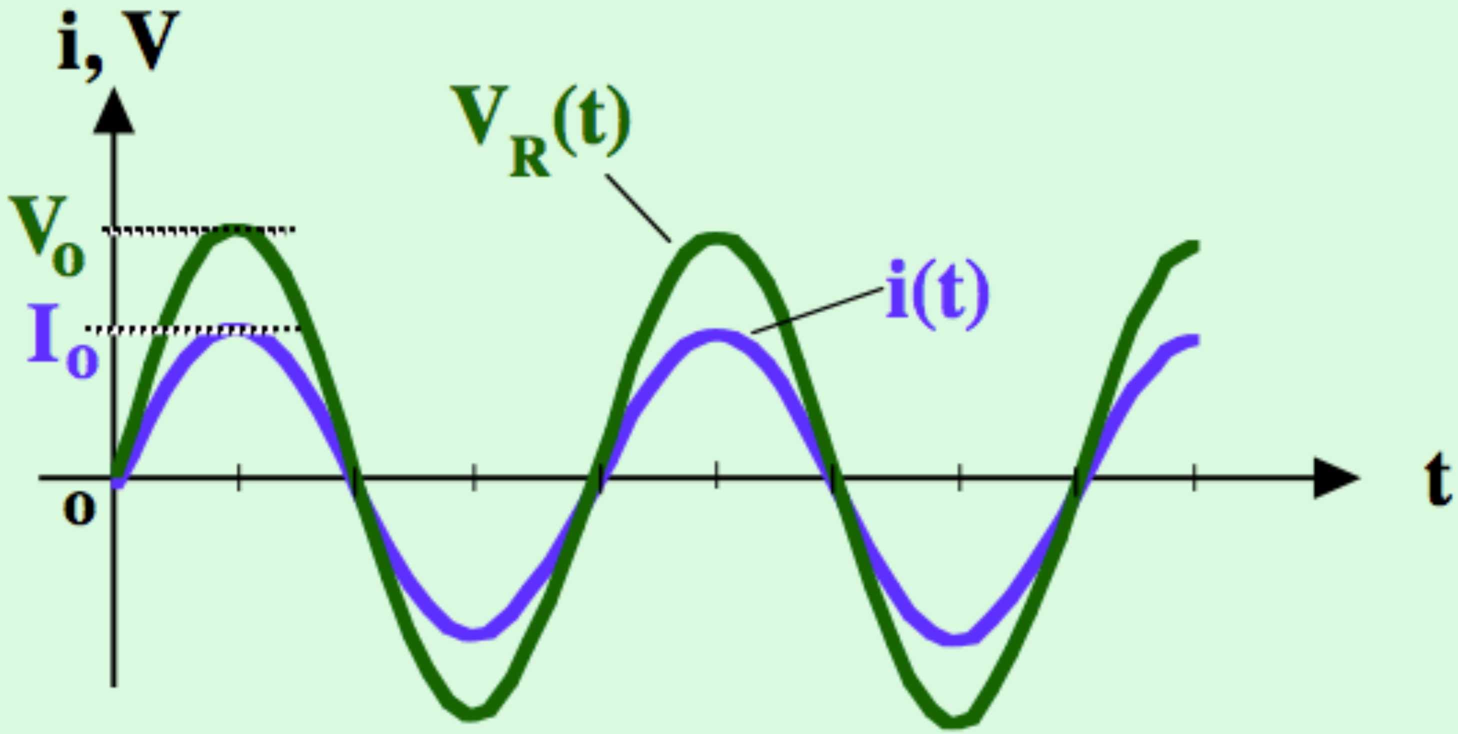
$$V_R(t) = R\, i(t) = R\, I_0 \ \mathrm{sen}\omega t$$

- $V_0 = R\, I_0$
- $\phi' = 0$

CIRCUITI IN CORRENTE ALTERNATA

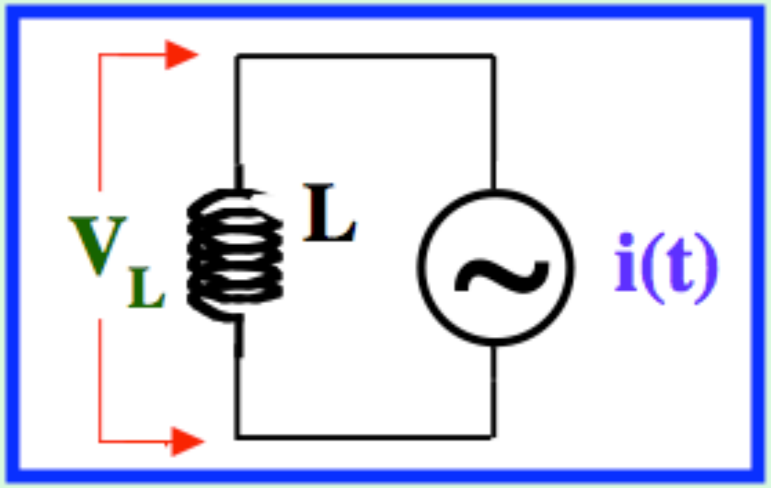
$$V_R(t) = R\, i(t) = R\, I_o\, \mathrm{sen}\omega t$$

- $V_o = R\, I_o$
- $\phi' = 0$



CIRCUITI IN CORRENTE ALTERNATA

circuito induttivo L



$$i(t) = I_o \, sen(\omega t) \longrightarrow V(t) = V_o \, sen(\omega t + \phi')$$

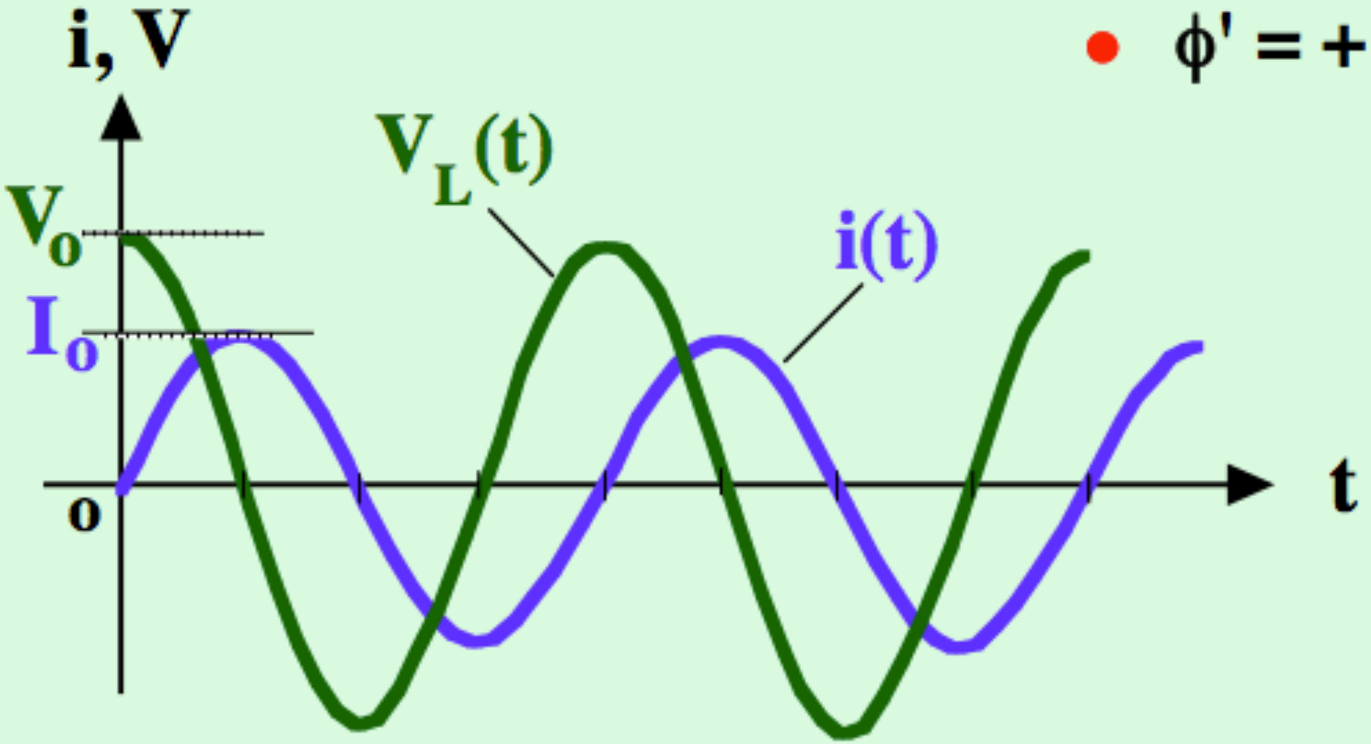
$$V_L(t) = L\frac{di(t)}{dt} = LI_o \, \omega \cos\omega t = LI_o \, \omega \, sen(\omega t + \frac{\pi}{2})$$

- $V = L \, I_o \, \omega$
- $\phi' = +\frac{\pi}{2}$

CIRCUITI IN CORRENTE ALTERNATA

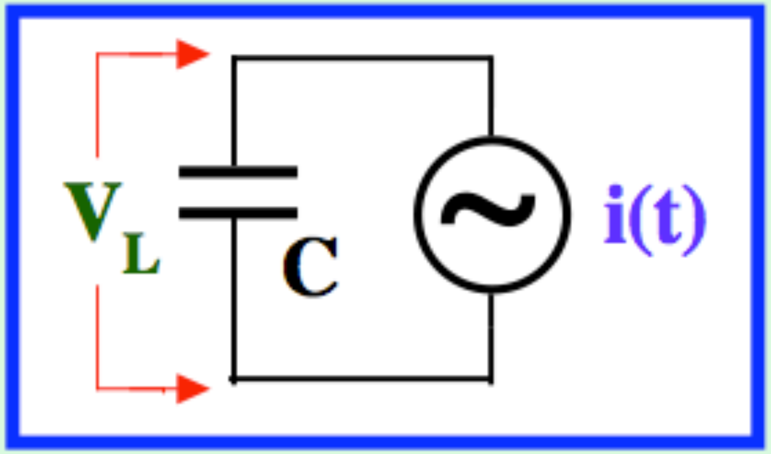
$$V_L(t) = L\frac{di(t)}{dt} = LI_o\,\omega\,\cos\omega t = LI_o\,\omega\,\mathrm{sen}(\omega t + \frac{\pi}{2})$$

- $V = L\,I_o\,\omega$
- $\phi' = +\frac{\pi}{2}$



CIRCUITI IN CORRENTE ALTERNATA

circuito capacitivo C



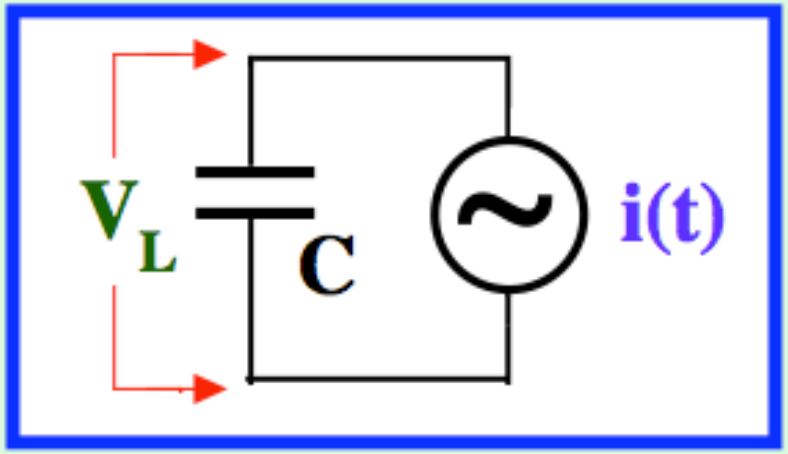
$$i(t) = I_o \, \text{sen}(\omega t) \rightarrow V(t) = V_o \, \text{sen}(\omega t + \phi')$$

$$i(t) = I_o \, \text{sen}(\omega t) = \frac{dQ(t)}{dt}$$

$$Q(t) = \int I_o \, \text{sen}\omega t \, dt = -\frac{I_o}{\omega} \cos\omega t$$

CIRCUITI IN CORRENTE ALTERNATA

circuito capacitivo C



$$Q(t) = \int I_o \operatorname{sen}\omega t \, dt = -\frac{I_o}{\omega} \cos\omega t$$

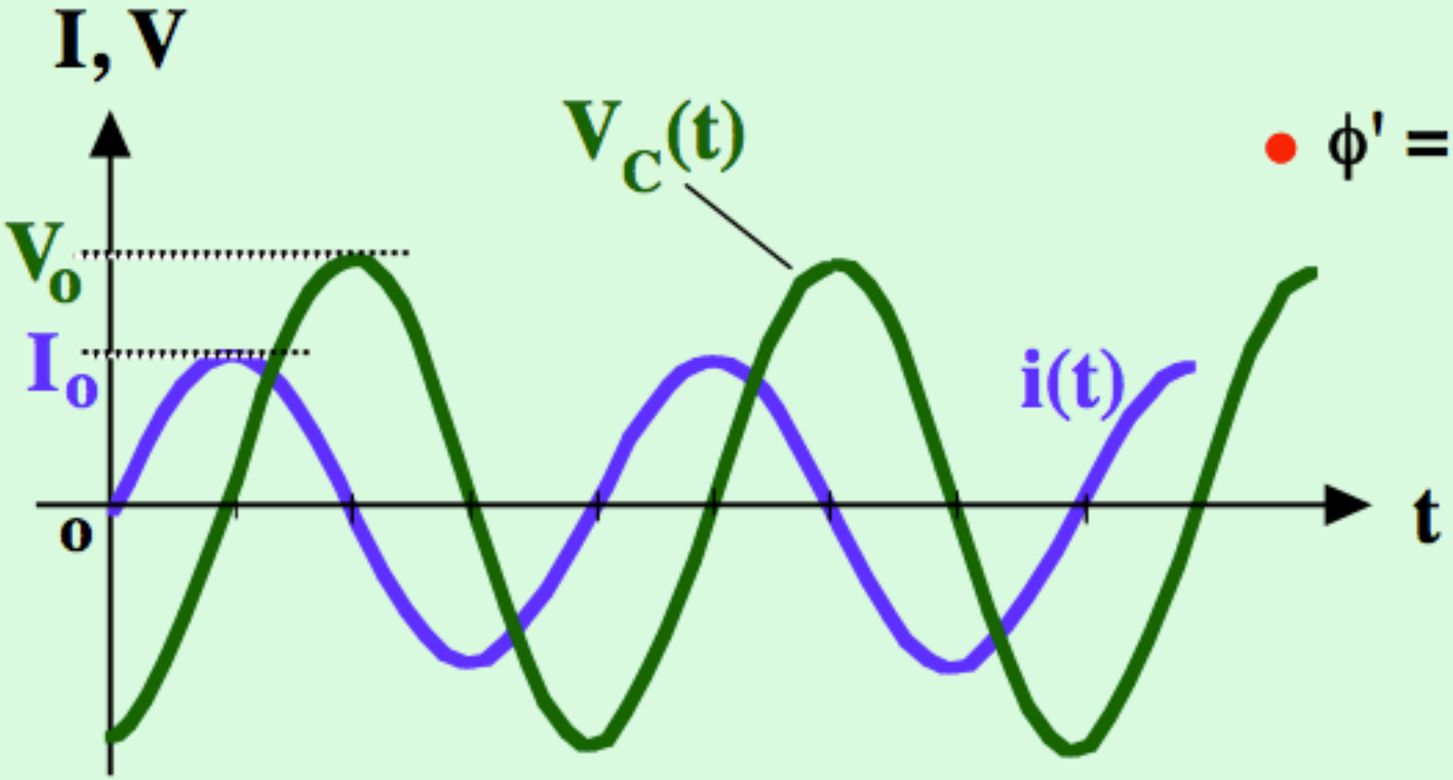
$$V_C(t) = \frac{Q(t)}{C} = -\frac{I_o}{\omega C} \cos\omega t = \frac{I_o}{\omega C} \operatorname{sen}(\omega t - \frac{\pi}{2})$$

- $V = \frac{I_o}{\omega C}$
- $\phi' = -\frac{\pi}{2}$

CIRCUITI IN CORRENTE ALTERNATA

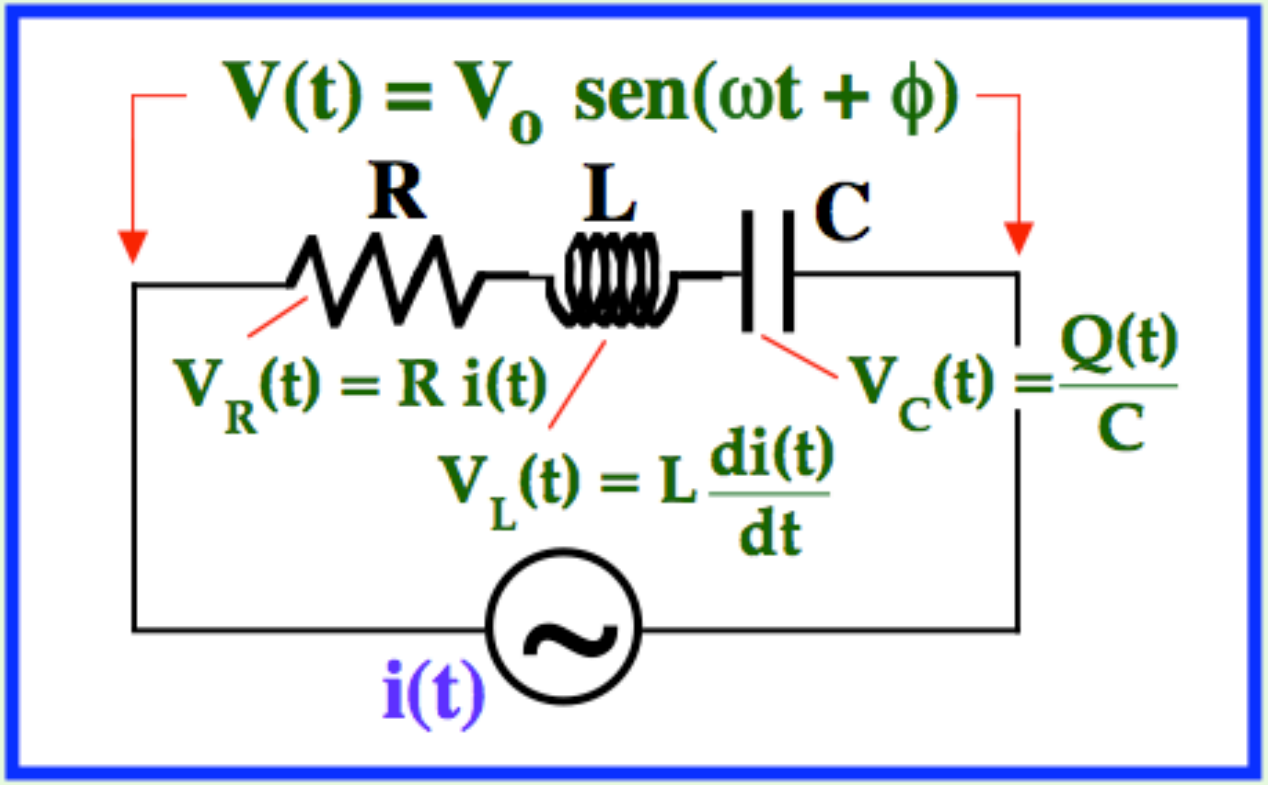
$$V_C(t) = \frac{Q(t)}{C} = -\frac{I_0}{\omega C}\cos\omega t = \frac{I_0}{\omega C}\,\mathrm{sen}(\omega t - \frac{\pi}{2})$$

- $V = \frac{I_0}{\omega C}$
- $\phi' = -\frac{\pi}{2}$



CIRCUITI IN CORRENTE ALTERNATA

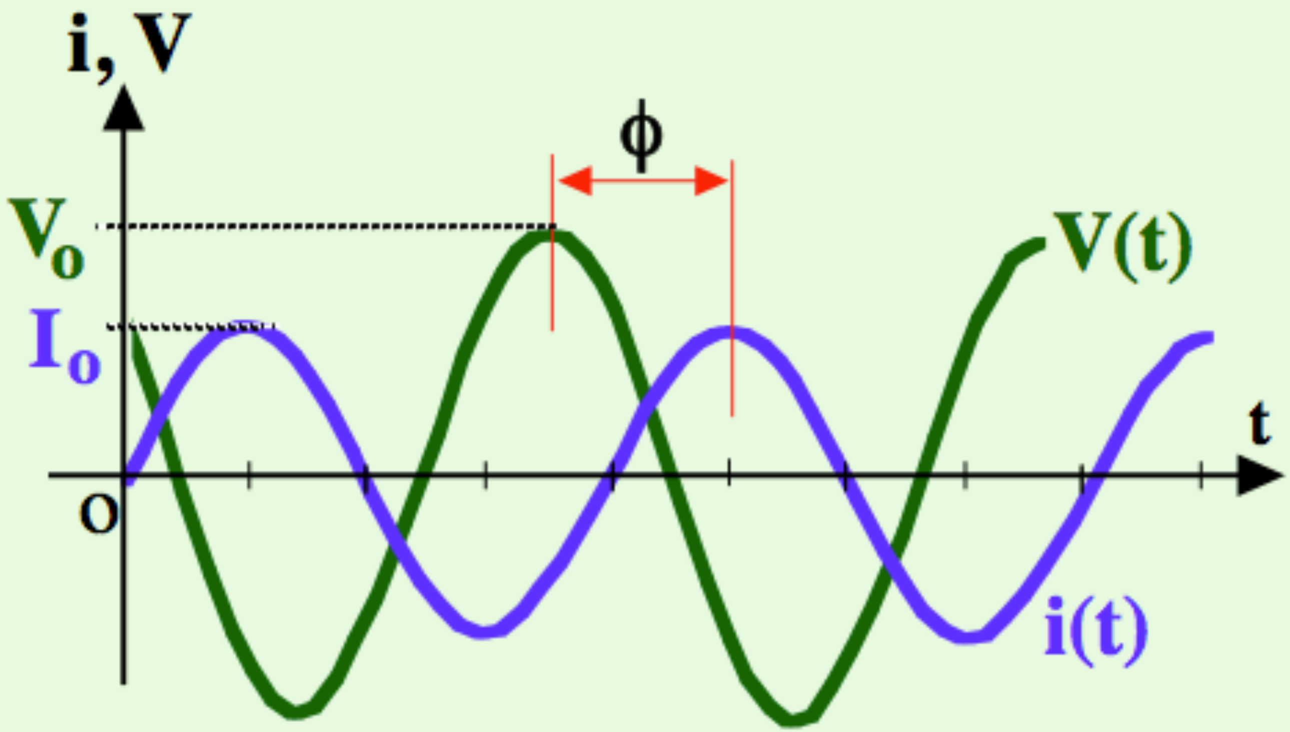
circuito RLC



$$i(t) = I_o \,\mathrm{sen}(\omega t) \longrightarrow V(t) = V_o \,\mathrm{sen}(\omega t + \phi)$$

CIRCUITI IN CORRENTE ALTERNATA

$$i(t) = I_o \operatorname{sen}(\omega t) \longrightarrow V(t) = V_o \operatorname{sen}(\omega t + \phi)$$



CIRCUITI IN CORRENTE ALTERNATA

- $V_o = I_o \sqrt{R^2 + \left[\omega L - \frac{1}{\omega C}\right]^2}$
- $\phi = \text{arctg} \frac{\omega L - \frac{1}{\omega C}}{R}$

impedenza elettrica

$$Z = \frac{V_o}{I_o} = \sqrt{R^2 + \left[\omega L - \frac{1}{\omega C}\right]^2}$$

dimensioni [impedenza Z] = $[M][L]^2[t]^{-3}[i]^{-2}$

- **unità di misura: S.I. ohm (Ω)**

CIRCUITI IN CORRENTE ALTERNATA

risonanza

impedenza elettrica

$$Z = \frac{V_0}{I_0} = \sqrt{R^2 + \left[\omega L - \frac{1}{\omega C}\right]^2}$$

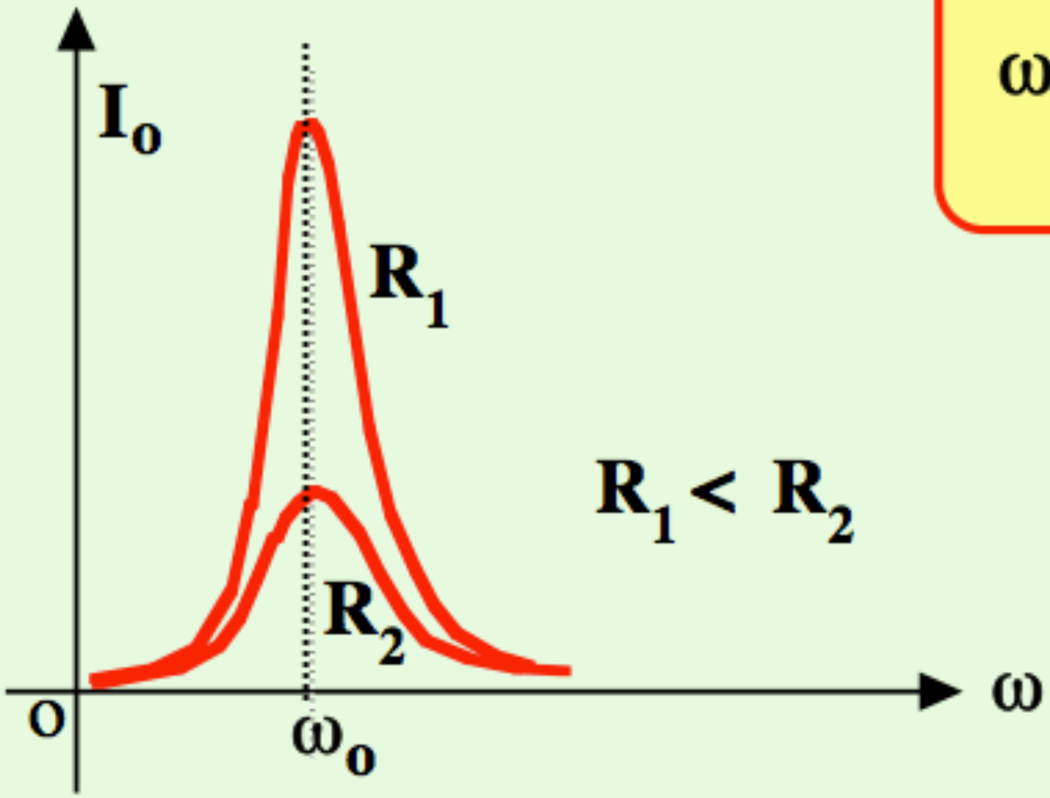
Z minima → $\left[\omega L - \frac{1}{\omega C}\right]^2 = 0$

$\phi = 0$ e $Z \equiv R$

risonanza $\omega \equiv \omega_0 = \sqrt{\frac{1}{LC}}$

CIRCUITI IN CORRENTE ALTERNATA

risonanza



$R_1 < R_2$

$$\omega \equiv \omega_0 = \sqrt{\frac{1}{LC}}$$

Frequenza di risonanza (in Hertz):

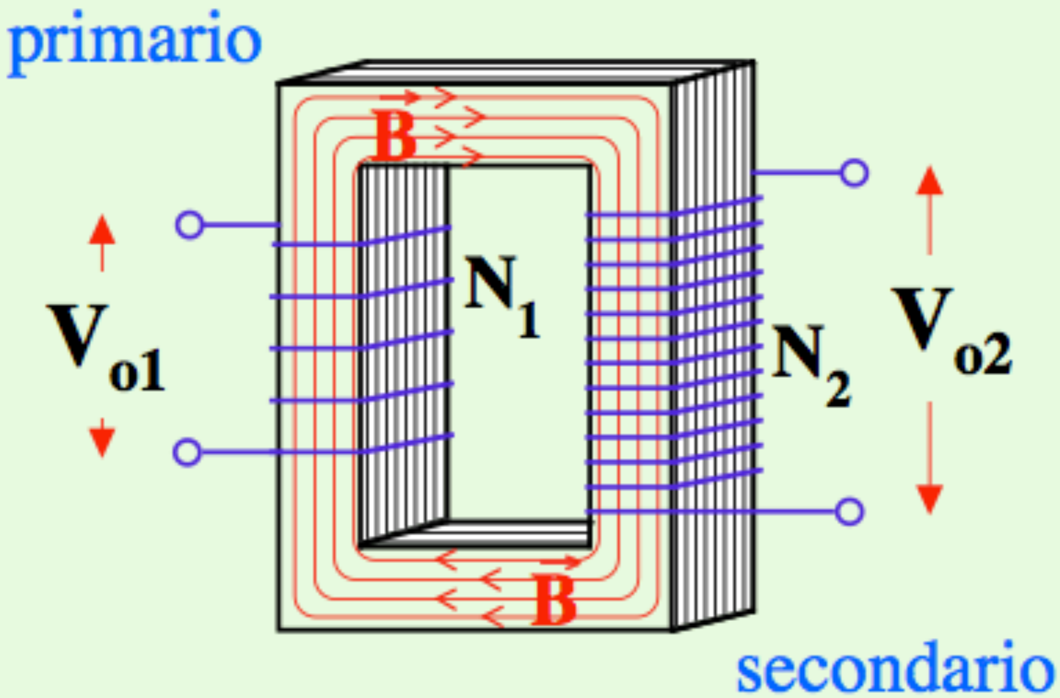
$$\nu_0 = \frac{\omega_0}{2\pi} = \frac{1}{2\pi}\sqrt{\frac{1}{LC}}$$

- **sintonizzazione radio/TV** (C variabile)

$$C = \frac{1}{L\,\omega_0^2}$$

TRASFORMATORE

corrente alternata

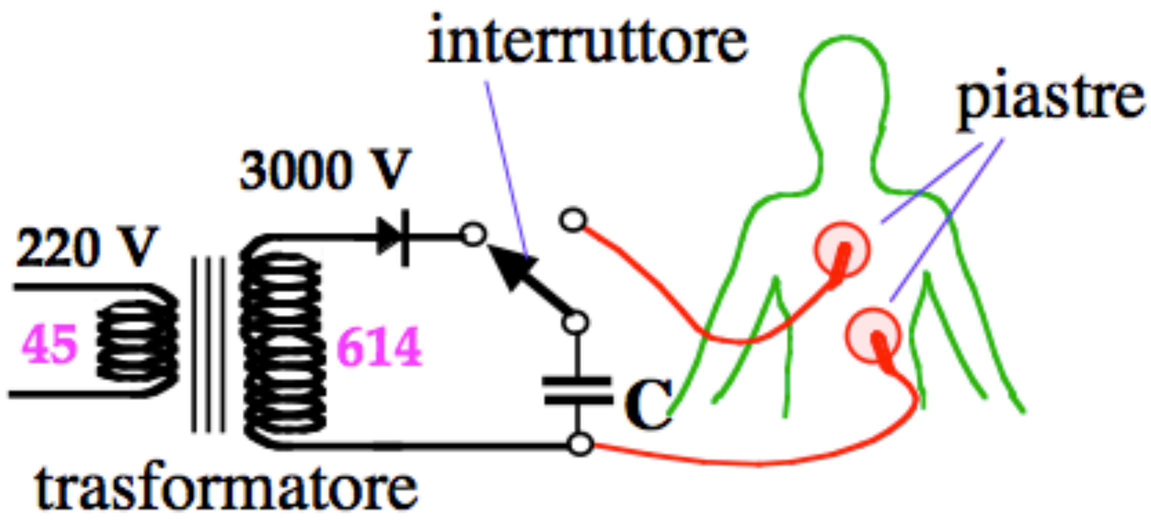


$$\frac{V_{o1}}{V_{o2}} = \frac{N_1}{N_2}$$

induzione elettromagnetica tra solenoidi concatenati con magnete permanente

- alta d.d.p. ⇄ bassa d.d.p.

DEFIBRILLATORE



$$V_{o2} = \frac{N_1}{N_2} V_{o1} = \frac{614}{45} 220\ V = 3000\ V$$

20 A per 5 ms → contrazione simultanea fibre muscolari cardiache

↓

RESET della contrazione