

# Analisi di un circuito RLC serie in regime sinusoidale

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## ① Apparato sperimentale

Circuito

Acquisizione e analisi

Svolgimento

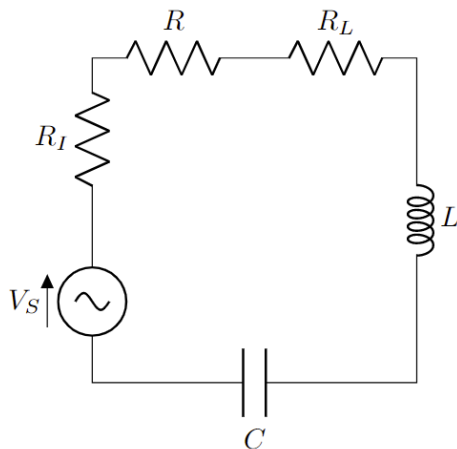
## ② Risultati

Studio qualitativo

Analisi dell'ampiezza

Analisi della fase

## ③ Conclusioni



$$R_I = 50\Omega$$

$$R = (330.0 \pm 0.3)\Omega$$

$$R_L = (34.5 \pm 0.1)\Omega$$

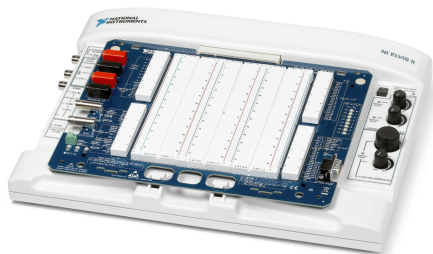
$$L = (10.3 \pm 0.1)mH$$

$$C = (45.5 \pm 0.4)nF$$

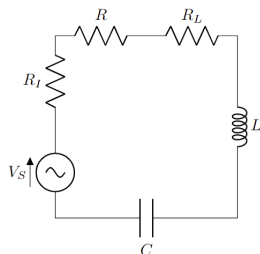
- Scheda Elvis II

- Programma scritto in LabVIEW

- Dati elaborati con il software ROOT



$$V(t) = V_0 \cos \omega t$$



$$i(t) = \frac{V_0}{\sqrt{R^2 + (\omega L - \frac{1}{\omega C})^2}} \cos [\omega t + (\arctan \frac{1 - \omega^2 LC}{\omega RC})]$$

$$R(\omega) = \frac{1}{1 + q^2 (\frac{\omega_0}{\omega} - \frac{\omega}{\omega_0})} \quad q = \frac{\omega_0 L}{R} = \frac{1}{R} \sqrt{\frac{L}{C}}$$

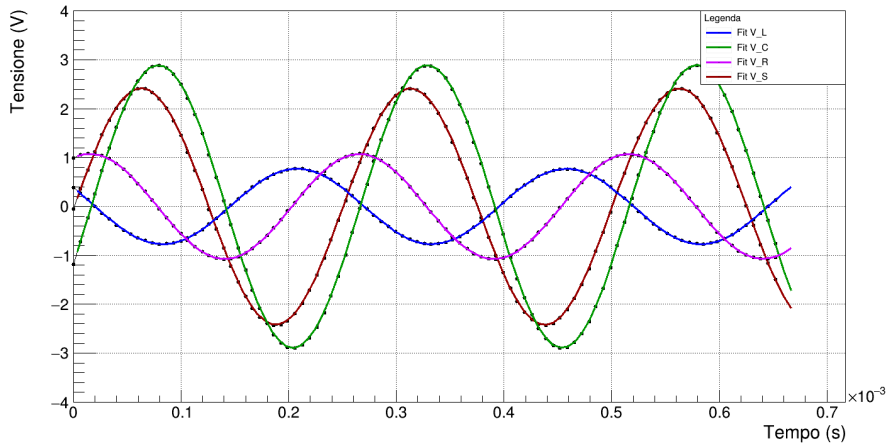
$$\omega_0 = \frac{1}{\sqrt{LC}}$$

Nel caso del nostro circuito

$$q \approx 1.5 \quad f_0 = (7351 \pm 68) \text{ Hz}$$

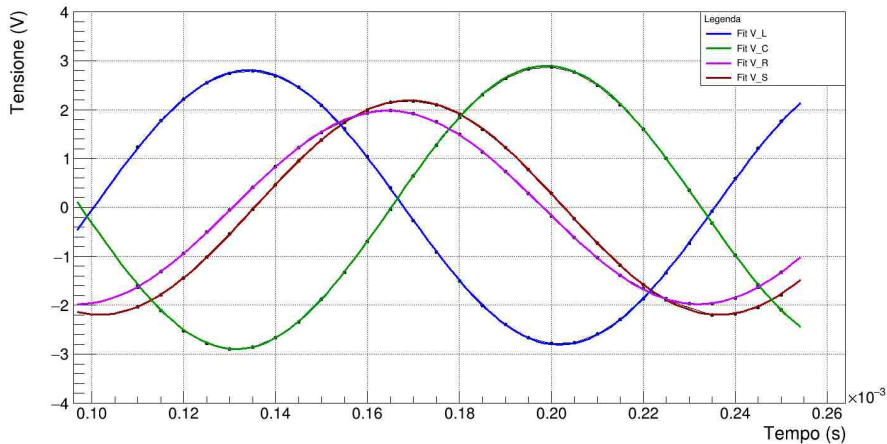
# Studio qualitativo: 4000Hz

Tensione alla frequenza di 4000 Hz



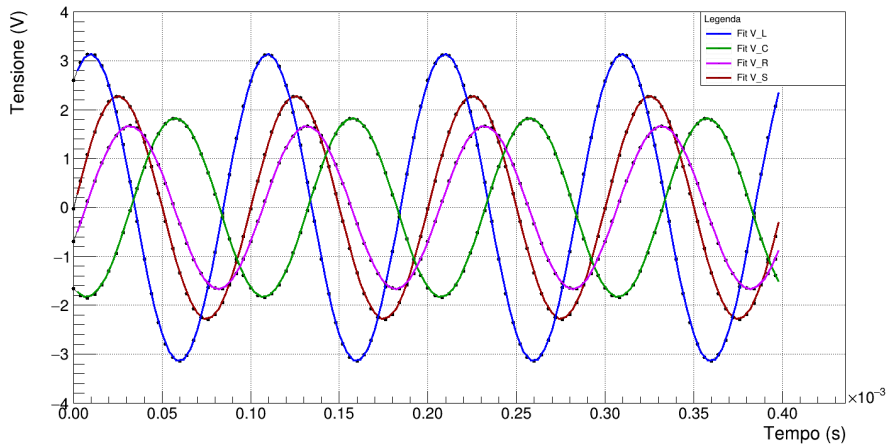
# Studio qualitativo: $f_0$

Tensione alla frequenza di risonanza



# Studio qualitativo: 10000Hz

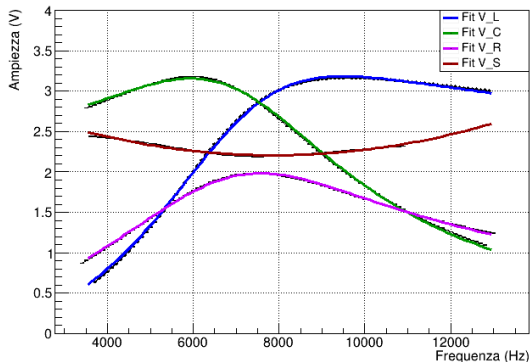
Tensione alla frequenza di 10000 Hz





# Analisi dell'ampiezza

Analisi in frequenza dell'ampiezza



$$A_R(w) = \frac{V_0 R}{\sqrt{R^2 + (wL - \frac{1}{wC})^2}}$$

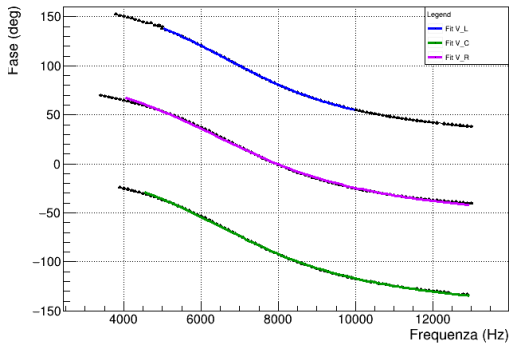
$$A_L(w) = \frac{V_0 wL}{\sqrt{R^2 + (wL - \frac{1}{wC})^2}}$$

$$A_C(w) = \frac{\frac{V_0}{wC}}{\sqrt{R^2 + (wL - \frac{1}{wC})^2}}$$

$$f_0s = (7562 \pm 5)Hz$$

# Analisi della fase

Analisi in frequenza della fase



$$\Phi_R(w) = \arctan \frac{1-w^2LC}{wRC}$$

$$\Phi_L(w) = \arctan \left( \frac{1-w^2LC}{wRC} \right) + \frac{\pi}{2}$$

$$\Phi_C(w) = \arctan \left( \frac{1-w^2LC}{wRC} \right) - \frac{\pi}{2}$$

# Conclusioni: problematiche e possibili soluzioni

$$f_0 = (7351 \pm 68) \text{ Hz}$$

$$f_{0s} = (7562 \pm 5) \text{ Hz}$$

- Resistenza  $R$  confrontabile con  $R_I$  e  $R_L$
- Sottostima dell'incertezza di  $f_{0s}$
- Confronto con le altre possibili misure di  $f_{0s}$
- Errori sistematici

# The End