Experiment-3

AC Circuit Analysis

Experiment's Goal

- Trying to measure the complex quantities of current and voltage in two different circuits

- Series AC circuit
- Parallel RLC circuit

Complex number representation

- We can show a complex number two forms
- Rectangular form as a real part and imaginary part

$$Z=a+jb$$

- Polar form as a magnitude and a phase angle

$$Z=|Z| < \alpha$$

While $|Z|=\sqrt{a^2+b^2}$ and $\alpha=\tan^{-1}(\frac{b}{a})$

AC circuit analysis

- Ohm's law for resistor

$$R=\frac{V_R}{I}$$

- Capacitor

$$X_C=\frac{V_C}{I}=\frac{1}{\omega_C}$$

- And Inductor

$$X_L=\frac{V_L}{I}=\omega_L$$

- Series Connections

$$I=I_1=I_2=I_3$$
$$V=V_1+V_2+V_3$$

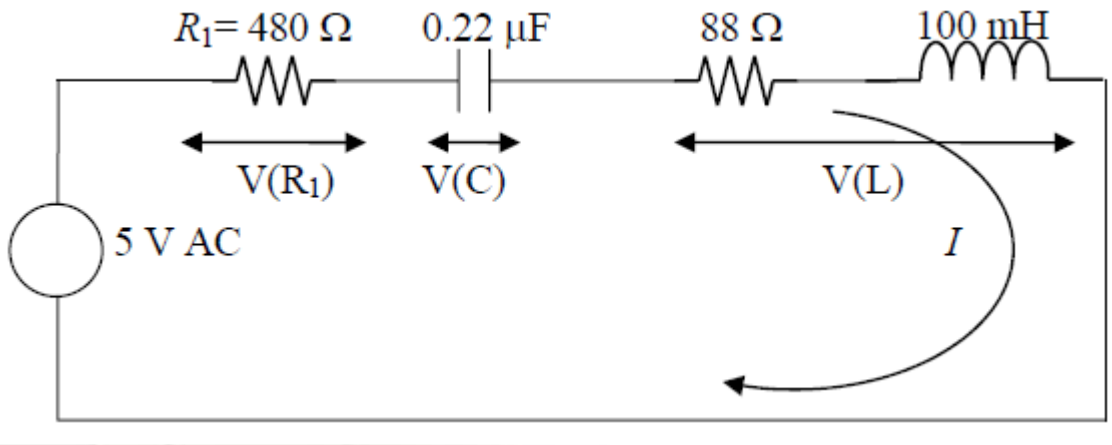
- Parallel connections

$$I=I_1+I_2+I_3$$
$$V=V_1=V_2=V_3$$

Mathematical Analysis of RLC Circuit

- RLC series:

$$Z = R + j\left(W_L - \frac{1}{W_C}\right)$$



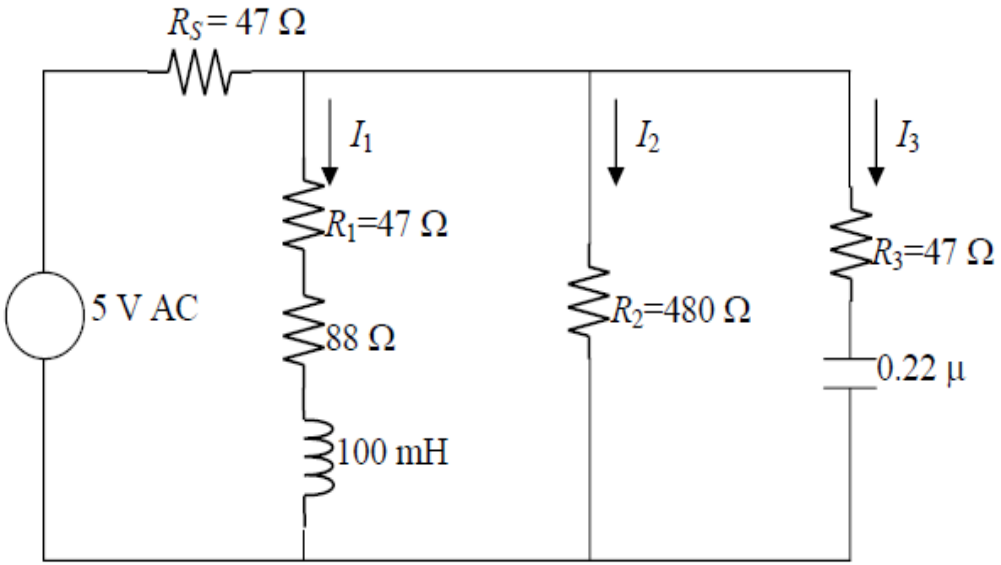
Mathematical Analysis of RLC Circuit

- RLC parallel:

I_1 : Z=R + j(W_L)

I_2 : Z=R

I_3 : Z=R + j(- $\frac{1}{W_C}$)



Note : By increasing W, Z_1 will increase, Z_2 will remain unchanged and Z_3 will decrease.

Required Data for Exp-3

- For RLC Series

a. Measure the amount of I, V(R), V(c) and V(L)
b. Fill the table (1)
c. Change the frequency from 500 to 1000 and record the voltages amount
d. show the trend of each V vs f(500-1000) and compare the results in your report

Note: I is constant and V varies across different components

Required Data for Exp-3

- For RLC Parallel

a. Fill the table (2) by measuring I_1, I_2, I_3
b. Increase the frequency from 500-1000 and collect different amounts of current.
c. Compare the data related to frequency equal to 1000

Note: Voltages are same across different components

References

1. Prof. Habash Webpage

2. Design soft: Kirchhoff's law in AC circuits: www.tina.com/English/tina/course/221kirch/kirch

3. The encyclopedia of science: Current lag and lead www.daviddarling.info/encyclopedia/C/current_lag_and_lead.html