Mississippi State University
Department of Physics and Astronomy
PH 2223 Lab

Phase and Impedance in an RLC Circuit

A simple way to analyze AC circuits is to draw the phasor diagram. Draw a phasor diagram for the circuit in your lab manual. Now how would the phasor diagram change if I removed the inductance? Do you know what capacitive and inductive reactance are? We shall go little more than the lab here on paper to get ourselves familiar with the theoretical structure. Therefore we are going to study RC filters.

Familiarize yourself with following equations which correspond to the circuit in Fig.1;

$$Z = \sqrt{R^2 + \frac{1}{(\omega C)^2}},$$

Here, **Z** is the impedance (resistance) in between points 'p' and 'r'.

$$V_R = IR \qquad\qquad V_c = \frac{I}{\omega C}$$

Here, $\mathbf{V_R}$ is the voltage measured in between points 'q' and 'r', $\mathbf{V_c}$ is the voltage measured in between points 'p' and 'q' and **I** is the current passing the circuit.

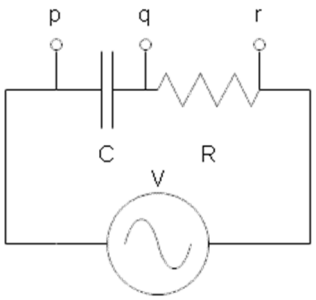

Fig.1: Circuit diagram of a RC circuit

1. Make sure you can get all the above equations without assistance.
2. Now if a current of frequency f ($\omega = 2\pi f$) is applied to points 'p' and 'r', what will be ratio of voltage applied to the voltage across the resistor? Name this $\mathbf{A_r}$.
3. What will be ratio of voltage applied to the voltage across the capacitor? Name this $\mathbf{A_c}$.
4. If you have high frequency current, which one do you think will be large? ($\mathbf{A_r}$ or $\mathbf{A_c}$ **?**)
5. If you have low frequency current, which one do you think will be large? ($\mathbf{A_r}$ or $\mathbf{A_c}$ **?**)
6. Which ports ('p' – 'q' / 'q' - 'r') will allow current of high frequency pass though. So this element acts as a high pass filter.
7. Which ports ('p' – 'q' / 'q' - 'r') will allow current of low frequency pass though. So this element acts as a low pass filter.

Challenge

Come to lab and construct the circuit in Fig. 1. Observe, note and report what you measure the voltage across 'p' – 'q' & 'q' - 'r' to be.