Name: _____ **Date:** _____

Introduction

In this exercise you will investigate the Theory of Superposition using a network containing two voltage sources and a complex RLC circuit

Procedure

For the circuit shown in Figure 3.1, determine the phasor voltages across each individual element using the **Superposition Theorem**. (You will be required to present either MathCad calculations or hand calculations to verify your results.) Express your answers in polar form.

Source #1 "ON", Source #2 "OFF"

$\tilde{V}_{L1}$ = _____ $\tilde{V}_{C1}$ = _____ $\tilde{V}_{R1}$ = _____

Source #1 "OFF", Source #2 "ON"

$\tilde{V}_{L2}$ = _____ $\tilde{V}_{C2}$ = _____ $\tilde{V}_{R2}$ = _____

Actual Voltages (Both Sources "ON")

$\tilde{V}_{L}$ = _____ $\tilde{V}_{C}$ = _____ $\tilde{V}_{R}$ = _____

Have your instructor verify your prelab calculations/results. **Instructor Initials:** _____

$\tilde{V}_1 = 1\angle 0°\ volts \quad f_1 = 3000\ Hz \quad \tilde{V}_2 = 1\angle 0°\ volts \quad f_2 = 3000\ Hz$

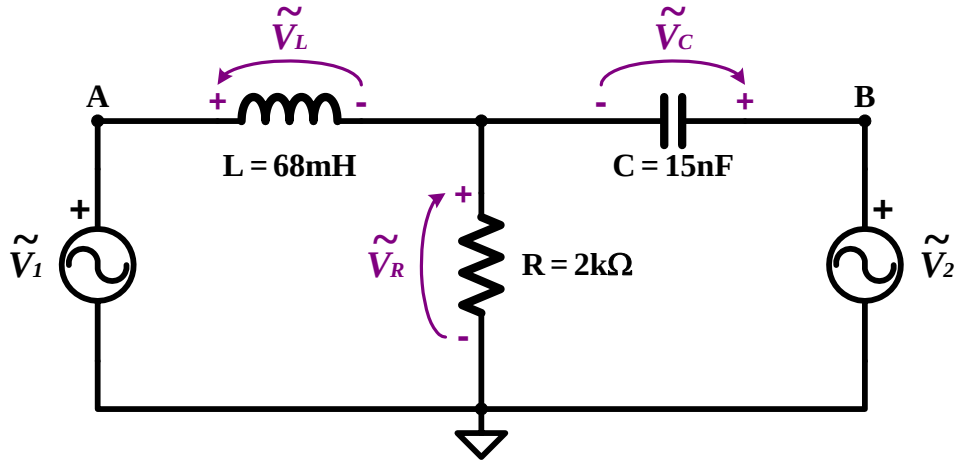

Figure 3.1 – RLC Circuit

Procedure

1. **Voltage Measurement with Source #1 "ON"** – Construct the circuit shown in Figure 3.1, but replace source #2 with a short-circuit. Set the function generator utilized for source #1 to output the voltage:

$$v_1(t) = 1 \cdot \sin(18850t) \text{ volts}$$

Measure and record the following phasor voltages (both expressed in polar form):

$\tilde{V}_1$ = _____ $\tilde{V}_{R1}$ = _____

2. **Voltage Measurement with Source #2 "ON"** – Construct the circuit shown in Figure 3.1, but replace source #1 with a short-circuit. Set the function generator utilized for source #1 to output the voltage:

$$v_2(t) = 1 \cdot \sin(18850t) \text{ volts}$$

Measure and record the following phasor voltages (expressed in polar form):

$\tilde{V}_2$ = _____ $\tilde{V}_{R2}$ = _____

3. **Voltage Measurement with both Sources "ON"** – Once again, repeat the measurements, but with both sources connected in the circuit and set :

$$v_2(t) = 1 \cdot \sin(18850t) \text{ volts}$$

Note – due to the limited number of available function generators, one generator will be used as both sources by connecting a single function generator as either source #1 or source #2, and then placing a short-circuit between nodes "A" and "B" in the circuit.

Measure and record the following phasor voltages (expressed in polar form):

$\tilde{V}_1 = \tilde{V}_2$ = _____ $\tilde{V}_R$ = _____

4. **Verification of the Inductor and Capacitor Voltages** – Measure the voltages across the inductor and the capacitor in the circuit with both sources turned on (similar to step 3).

Utilize the oscilloscope's math function and display CH1-CH2 in order to perform this measurement.

Measure and record the following phasor voltages (expressed in polar form):

$\tilde{V}_L$ = _____ $\tilde{V}_C$ = _____

Have your instructor verify your measured results. **Instructor Initials: _____**

Report Guide

1. Determine the relative difference between all of your measured and calculated voltage magnitudes.

2. Determine the relative difference between all of your measured and calculated phase angles.

Remember when asked to compare the relative difference of A with B, the preferred method is:

$$RD\% = \frac{A - B}{B} \cdot 100\%$$

3. Calculate the total power dissipated in the resistor by summing the powers dissipated in the resistor with respect to each source being turned on individually. Also, calculate the power dissipated in the resistor using the actual voltage across each resistor with both sources turned on simultaneously.

Compare both sets of calculated values to determine the superposition theorem valid for power as well as for voltage? Discuss your results.

4. Unless required as a formal report, submit your tabulated results and calculations with a cover sheet. Include these laboratory sheets as raw data attached to the end of your submission.