LAB #06
AC Superposition

Fall 2022

CSE-203L CS 2 LAB

Submitted by: MUHAMMAD SADEEQ

Registration No.: 21PWCSE2028

Section: C

"On my honor, as a student of the University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work"

Submitted to:

Engr. Faiz Ullah

(29 Nov 2022)

Department of Computer systems engineering
University of Engineering and Technology, Peshawar

Objective:

This exercise examines the analysis of multi-source AC circuits using the Superposition Theorem. In particular, sources with differing frequencies will be used to illustrate the contributions of each source to the combined result.

Theory Overview:

The Superposition Theorem can be used to analyze multi-source AC linear bilateral networks. Each source is considered in turn, with the remaining sources replaced by their internal impedance, and appropriate series-parallel analysis techniques employed. The resulting signals are then summed to produce the combined output signal. To see this process more clearly, the exercise will utilize two sources operating at different frequencies. Note that as each source has a different frequency, the inductor and capacitor appear as different reactance to the two sources.

Equipment:

1. AC Function Generators

2. Oscilloscope

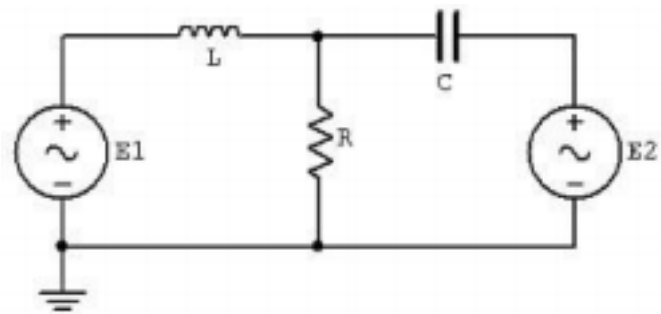## Components:

1. 0 .1 µF

2. 10mH

3. 1kΩ

Figure 1

Procedure:

To test the Superposition Theorem, sources E1 and E2 will be examined separately and then together.

Source One Only:

1. Consider the circuit of Figure 1 with C=0.1 µF, L=10mH, R=1kΩ, using only source E1=2 V p-p at 1 kHz and with source E2 replaced by a 0-V voltage source represented as a short circuit. Using standard series parallel techniques; calculate the voltages across R. Record the results in Table 1.

2. Build the circuit of Figure 1 using C=0.1 µF, L=10mH, and R=1kΩ. Replace E2 with 0-V voltage source represented as a short circuit. Set E1 to 2V p-p at 1 kHz, unloaded. Place probe one across E1 and probe two across R. Measure the voltages across R, and record in Table 1.

Source Two Only:

3. Consider the circuit of Figure 1 using only source E2=2 V p-p at 10 kHz and with source E1 replaced by 0-V voltage source represented as a short circuit. Using standard series-parallel techniques; calculate the voltages across R. Record the results in Table 2.

4. Replace the short circuit with source E2 and set it to 2Vp-p at 10 kHz, unloaded. Replace E1 with 0-V voltage source represented as a short circuit. Place probe one across E2 and probe two across R. Measure the voltages across R and record in Table 2.

Sources One and Two:

5. Consider the circuit of Figure 1 using both sources, E1=2Vp-p at 1 kHz and E2=2Vp-p at 10 kHz. Add the calculated voltages across R from Tables 1 and 2. Record the results in Table 3.

6. Replace the short circuit with source E1 and set it to 2Vp-p at 1 kHz, unloaded. Both sources should now be active. Place probe one across R. Measure the voltages across R, and record in Table 3.

7. Repeat the experiment for 1uF capacitor, 1mH inductor and 1kΩ resistor.

Data Tables (1st Exp)

Source One Only:

	Theoretical	Experimental	% Deviation
V_R	2.0778	2	3.744

Table 1

Source Two Only:

	Theoretical	Experimental	% Deviation
V_R	2.6196	2.7	3.069

Table 2

Sources One and Two:

	Theoretical	Experimental	% Deviation
V_R	4.6974	4.7	0.055

Table 3

Data Tables (2nd Exp)

Source One Only:

	Theoretical	Experimental	% Deviation
V_R	3.6077	3.6	0.213

Table 1

Source Two Only:

	Theoretical	Experimental	% Deviation
V_R	48.353	48.5	0.304

Table 2

Sources One and Two:

	Theoretical	Experimental	% Deviation
V_R	51.96	51	1.847

Table 3

Questions

1. **Why must the sources be replaced with a 50 Ω resistor instead of being shorted?**

   Because ideally, the current across the circuit would be infinite.

2. **Do the expected maxima and minima from step 6 match what is measured in step 7?**

   No they don't.

3. **Does one source tend to dominate the 1kΩ resistor voltage or do both sources contribute in nearly equal amounts? Will this always be the case?**

   No, the sources contribute according to the impendence. If reactance at a single source need more amount of energy, then it will contribute less to resistance.

   There will be equal contribution if reactance on both sides are equal.