

ELEC 2110

# Electric Circuit Analysis

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Section 002

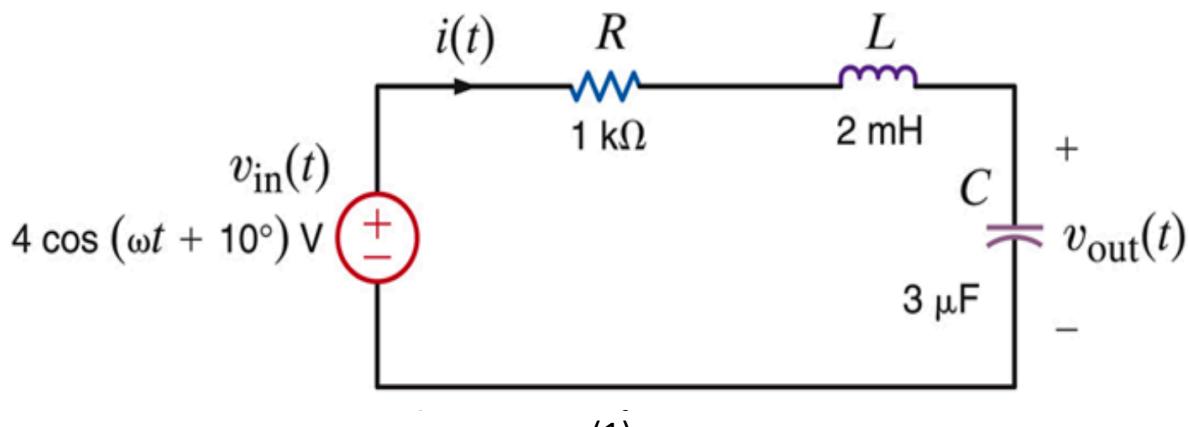
Recitation and MultiSim: AC Analysis

## Introduction

In this lab, the student will learn AC steady state circuit calculations, and learn to perform AC Analysis using MultiSim circuit simulator. The student will be given a circuit, and calculate the value of  $V(t)$  and/or  $i(t)$ , then simulate the circuit in MultiSim to verify the answer.

## Exercise 1

Calculate  $i(t)$  and  $V(t)$  if frequency = 60Hz for circuit 1. Simulate in MultiSim and perform AC Sweep and plot magnitude and phase.

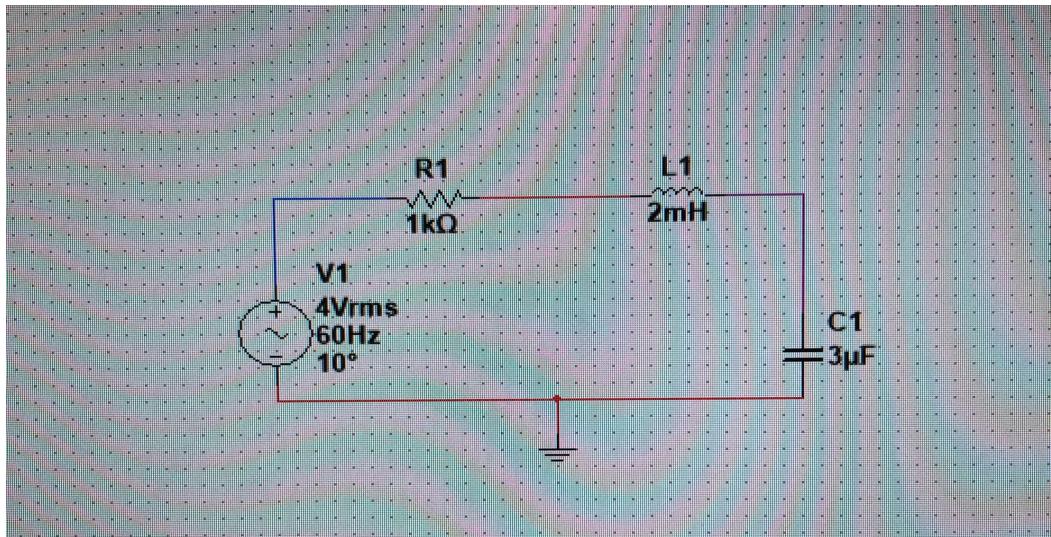


Circuit 1 for exercise 1

1.)  $V_{out}(t) = 2.65 \cos(377t - 38.54^\circ) V$   
 $i(t) = 2.998 \cos(377t - 51.458^\circ) mA$

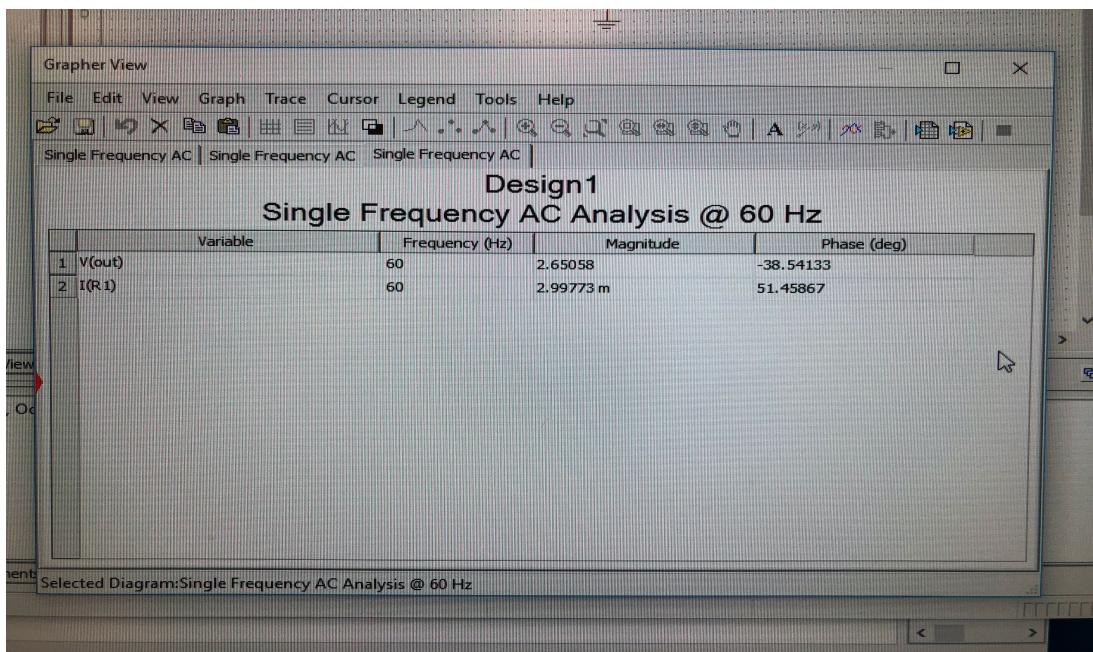
(2)

Hand-written equations



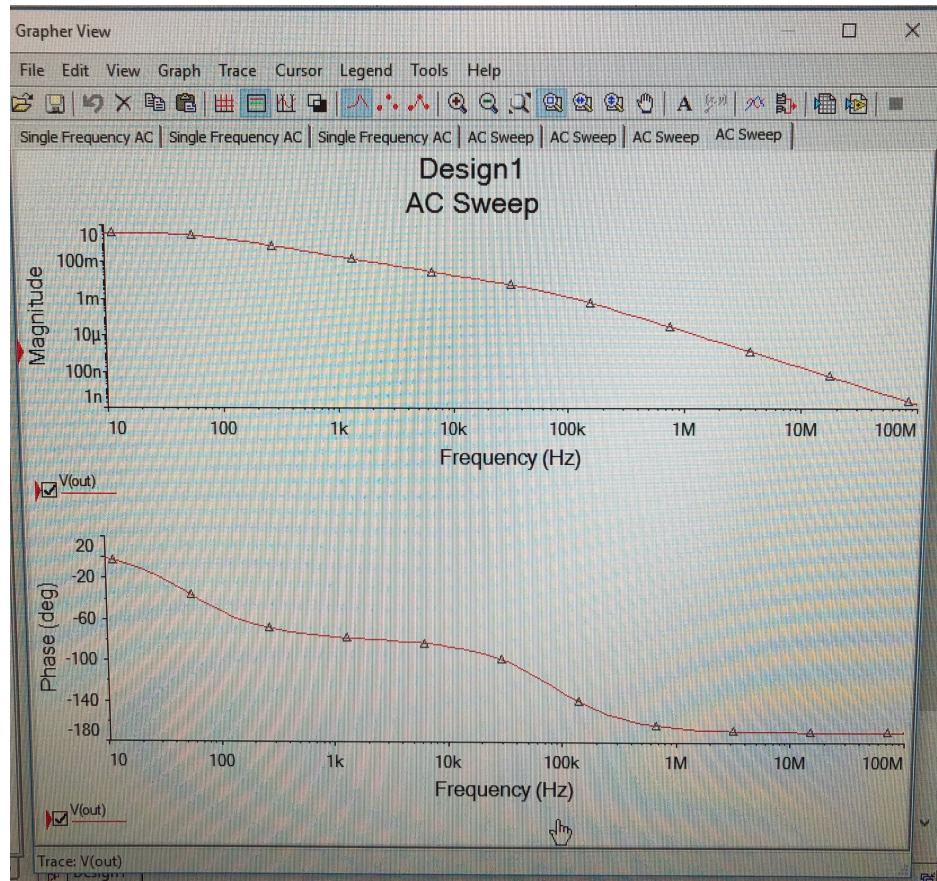
(3)

Circuit in MultiSim



(4)

AC Sweep



(5)

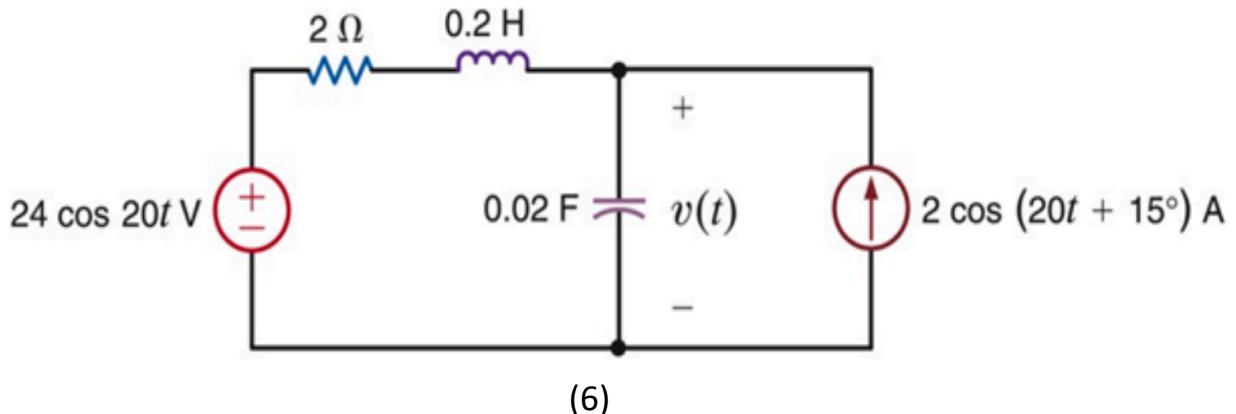
Magnitude and phase plot

Summary Table

Variable	Frequency (Hz)	Magnitude	Phase (degrees)
V(t)out	60	2.651	-38.54
I(t)in	60	2.998	51.46

## Exercise 2

Calculate  $V(t)$  for circuit 2. Simulate in MultiSim and perform AC Sweep and plot magnitude and phase.



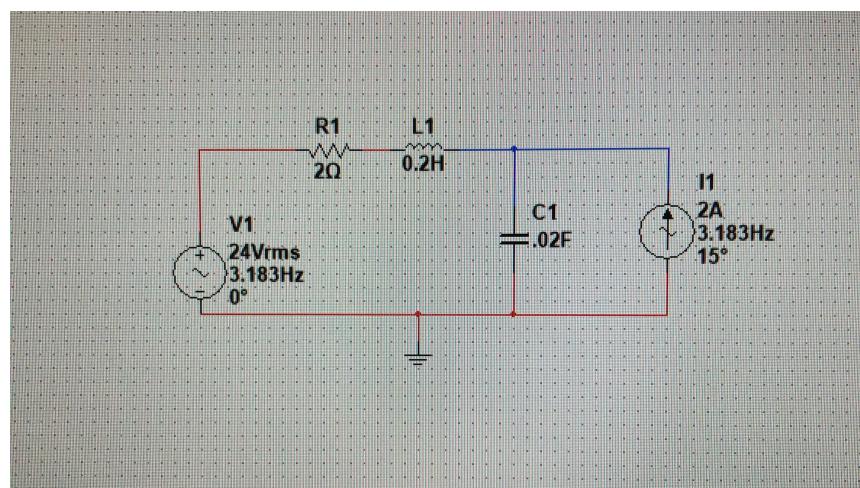
(6)

Circuit 2 for exercise 2

2.)  $V(t) = 27.241 \cos (20t - 108.1^\circ)$  V

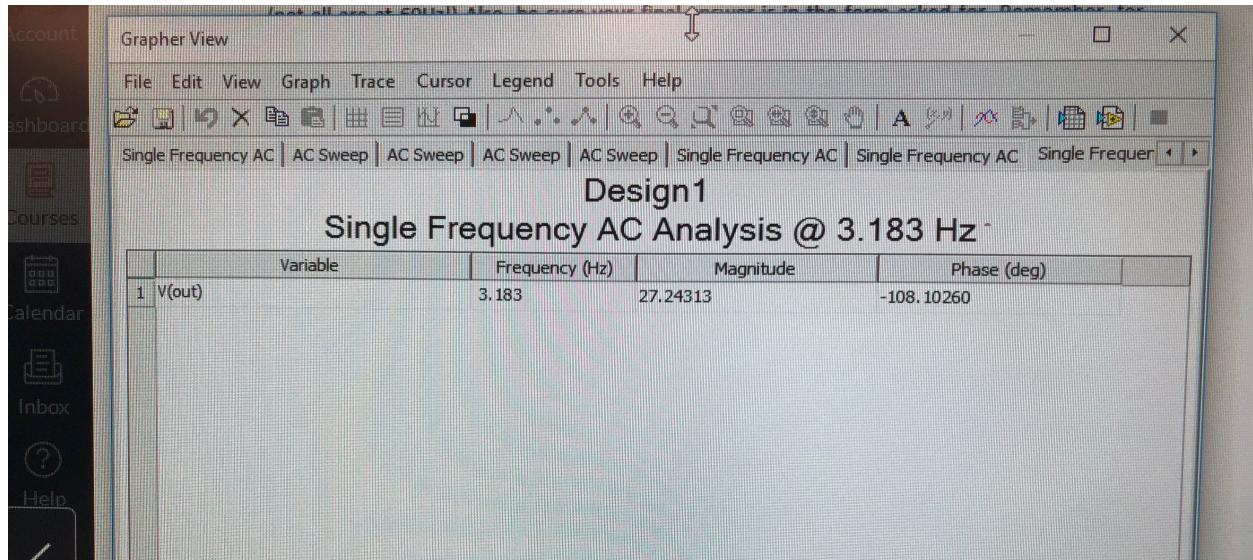
(7)

Final for exercise 2



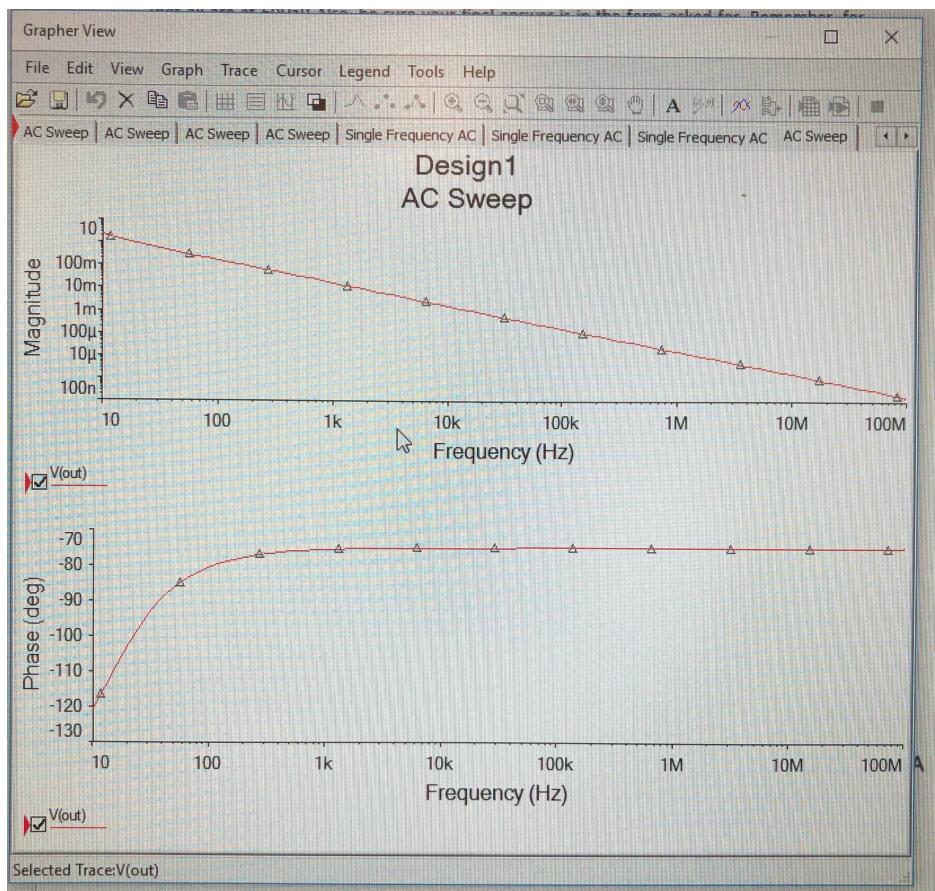
(8)

Circuit in MultiSim



(9)

### AC Sweep



(10)

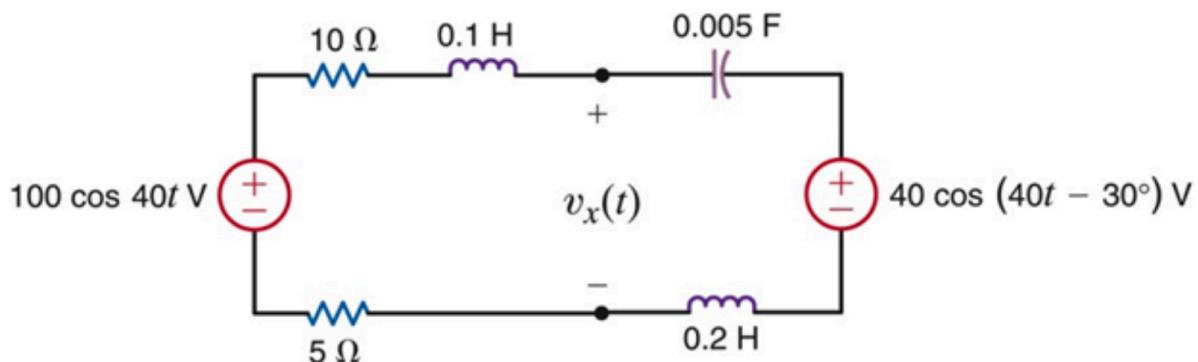
### Magnitude and phase plot

Summary Table

Variable	Frequency (Hz)	Magnitude	Phase (degrees)
V(t)	3.183	27.241	-108.103

### Exercise 3

Calculate V(t) for circuit 3. Simulate in MultiSim and perform AC Sweep and plot magnitude and phase.

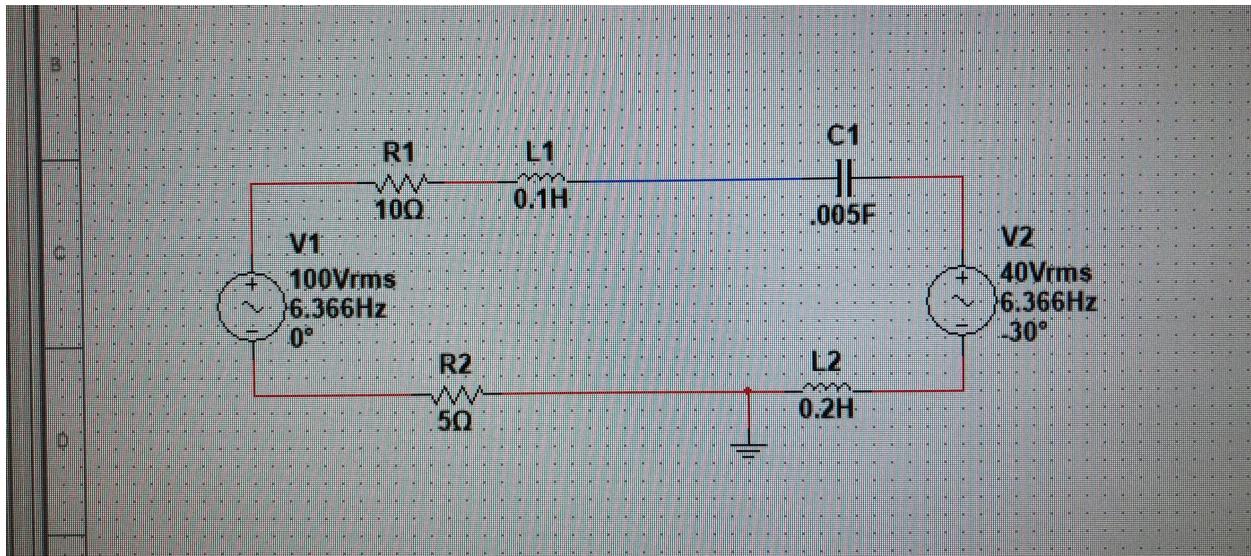


Handwritten solution:

$$3.) v_x(t) = 37.18 \cos (40t - 12.0^\circ) V$$

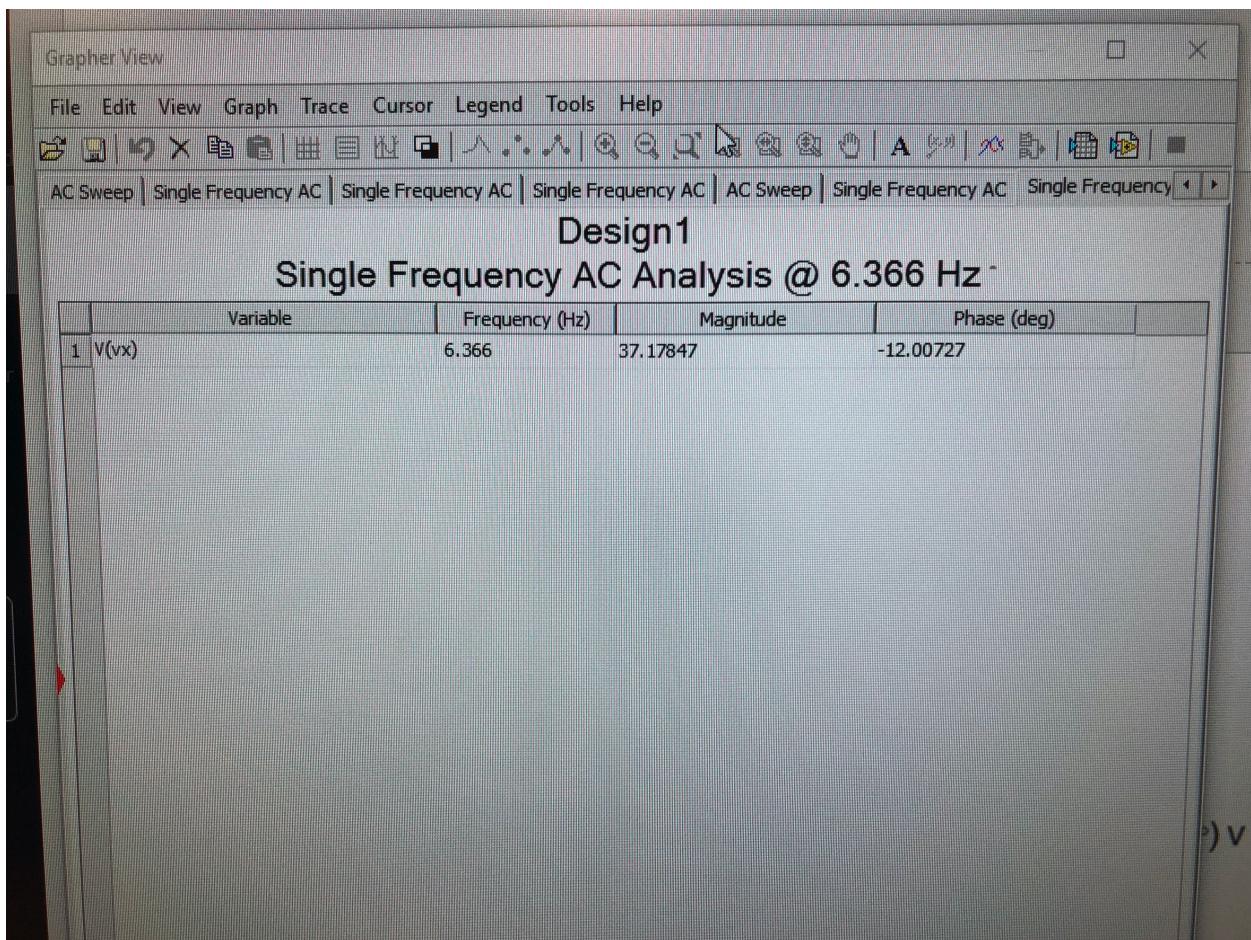
(12)

Final for exercise 3



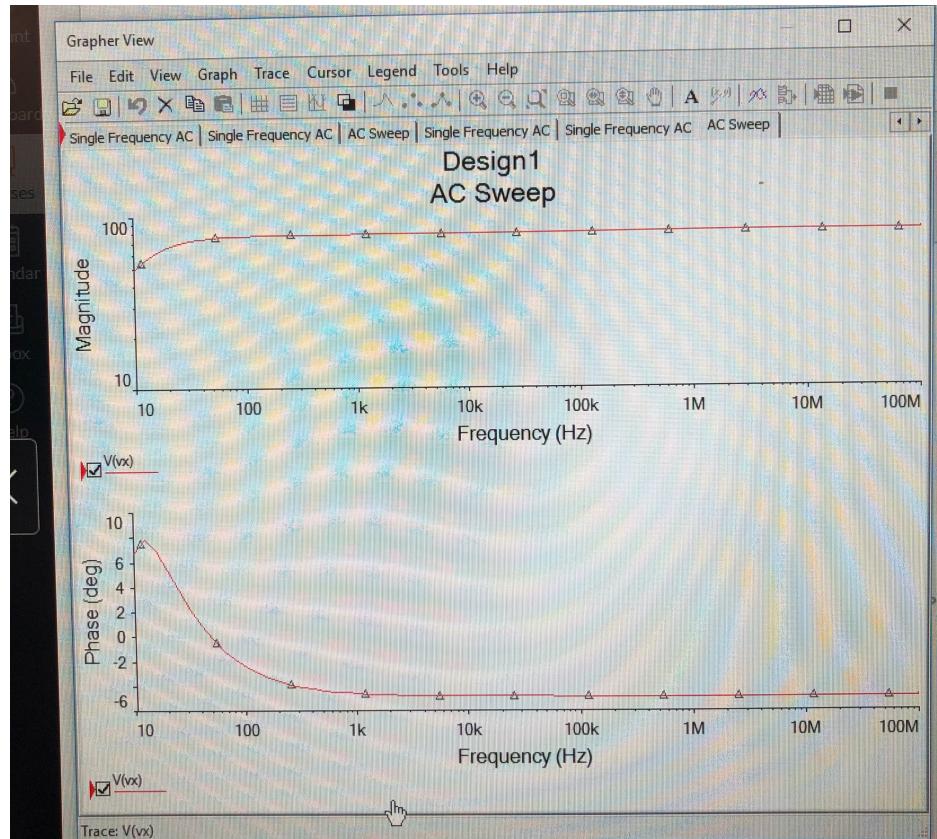
(13)

MultiSim for exercise 3



(14)

AC Sweep for exercise 3



(15)

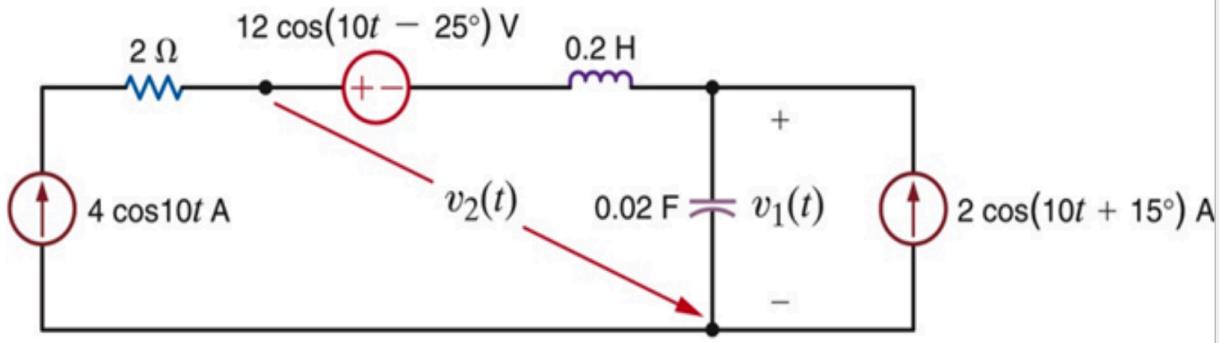
Magnitude and phase plot

Summary Table

Variable	Frequency (Hz)	Magnitude	Phase (degrees)
V(t)	6.366	37.18	-12.01

### Exercise 4

Calculate  $V(t)_1$  and  $V(t)_2$  for circuit 4. Simulate in MultiSim and perform AC Sweep and plot magnitude and phase.



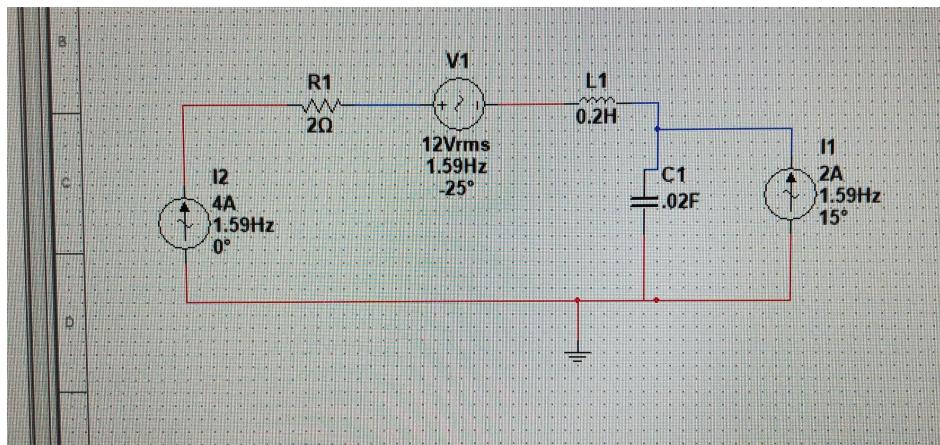
(16)

Circuit 4 for exercise 4

4.)  $v_1(t) = 29.77 \cos(10t - 85.01^\circ) V$   
 $v_2(t) = 29.93 \cos(10t + 116.71^\circ) V$

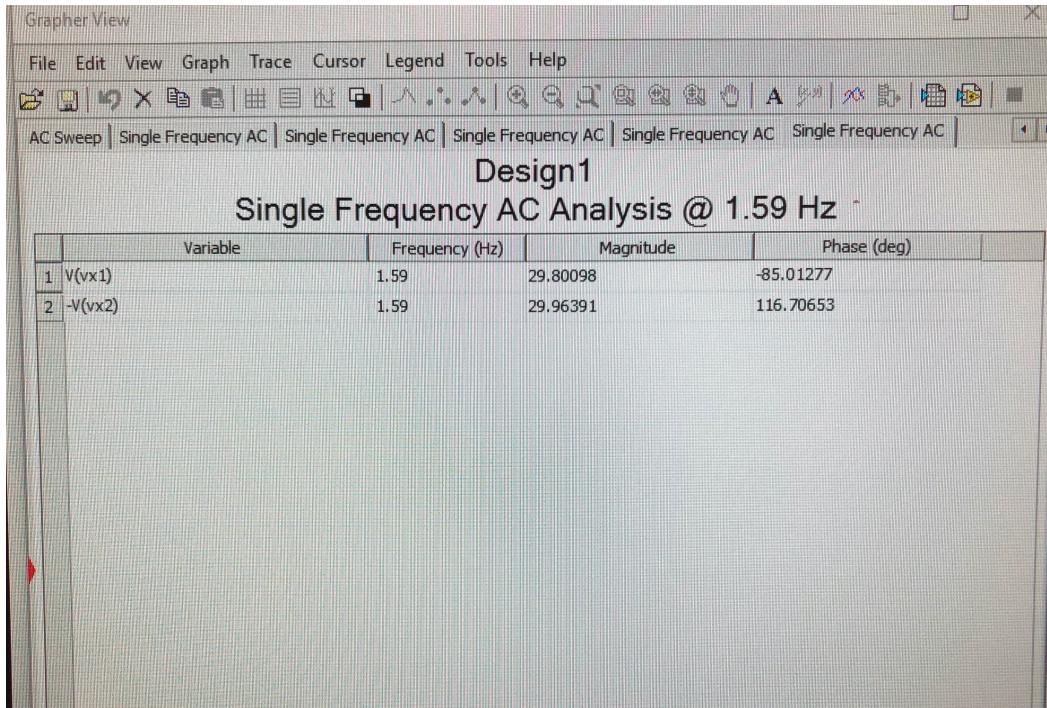
(17)

Final for exercise 4



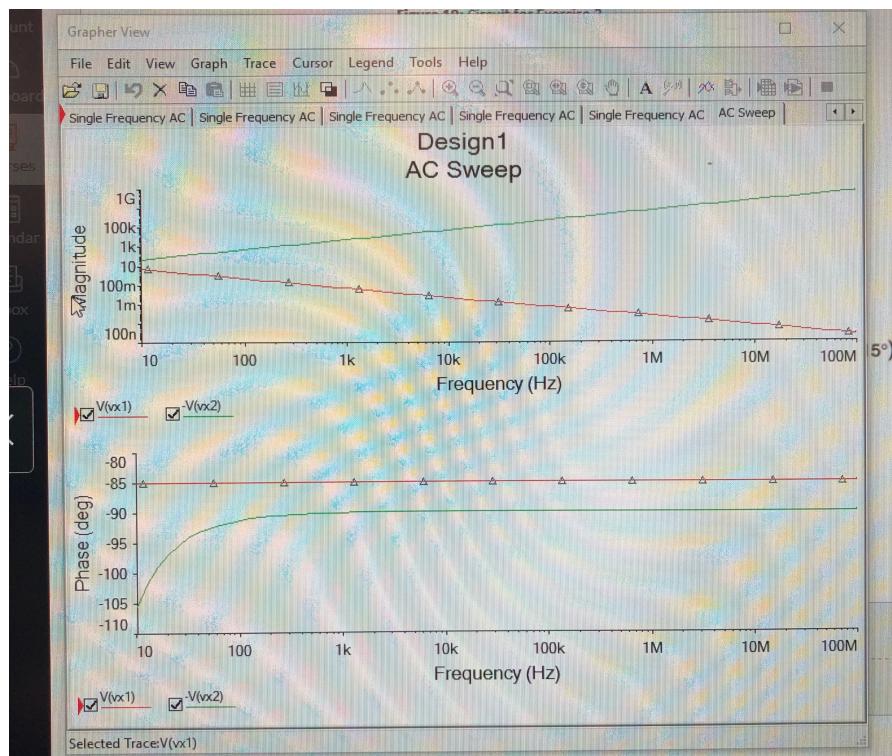
(18)

MultiSim circuit for exercise 4



(19)

### AC Sweep



(20)

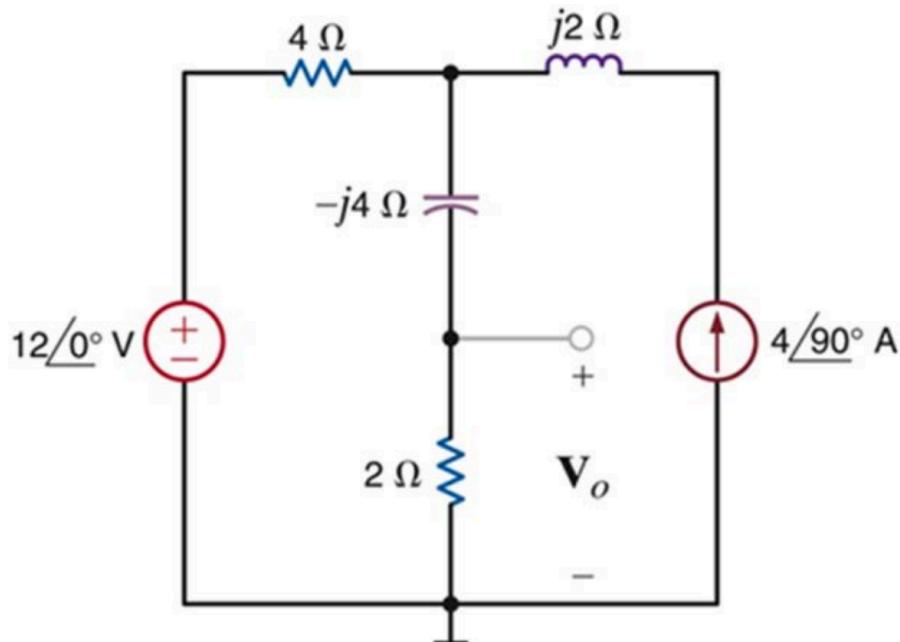
### Magnitude and phase plot

Summary Table

Variable	Frequency (Hz)	Magnitude	Phase (degrees)
$V(t)1$	1.59	29.801	-85.013
$V(t)2$	1.59	29.964	116.707

### Exercise 5

Calculate  $V(0)$  for circuit 5. Simulate in MultiSim and perform AC Sweep.



(21)

Circuit 5 for exercise 5

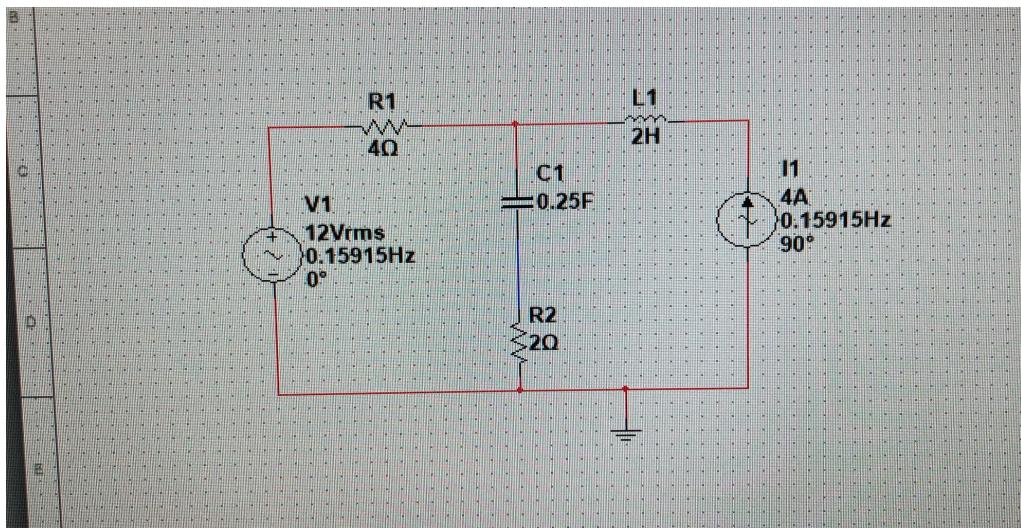
$$5.) V_o = 5.46 \angle 86.81^\circ V$$

0.15915Hz

0°, 90°

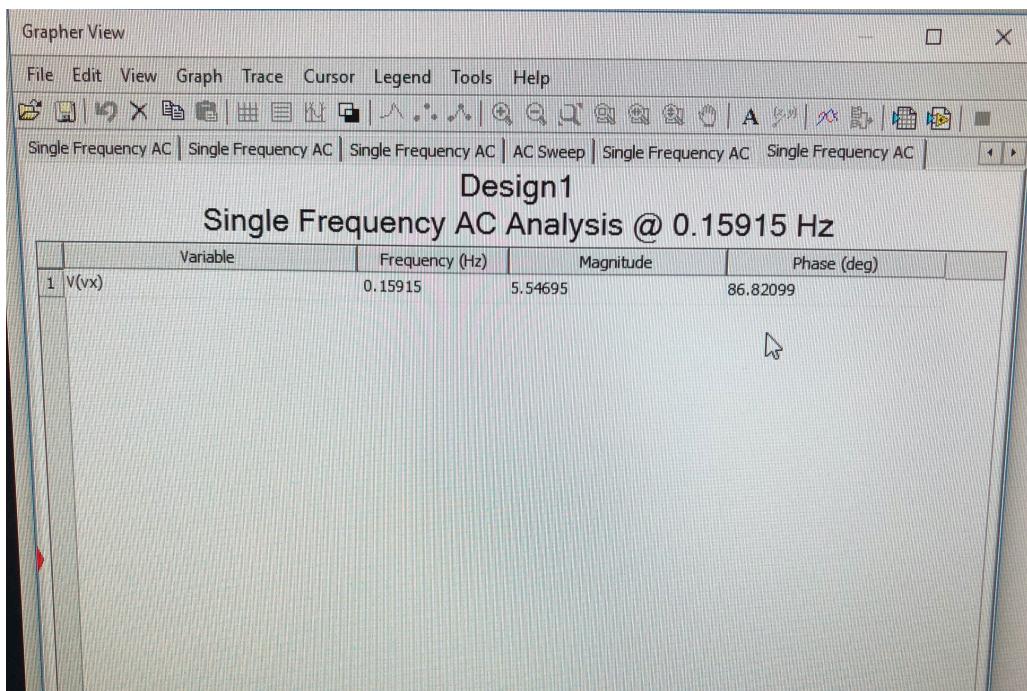
(22)

Final equation for exercise 5



(23)

MultiSim circuit exercise 5



(24)

AC Sweep

Summary Table

Variable	Frequency (Hz)	Magnitude	Phase (degrees)
V(t)	0.15915	5.547	86.821

## Conclusion

Lab 9 was based on switching everything learned previously in this course to AC circuits. AC Circuits are very important since that is the main energy source used in the United States and is used every day. This will become a very important step in becoming an electrical engineer.

## Bibliography

1. Circuit 1 for exercise 1
2. Equation for exercise 1
3. MultiSim of circuit exercise 1
4. AC Sweep exercise 1
5. Magnitude and Phase plot exercise 1
6. Circuit 2 for exercise 2
7. Equation for exercise 2
8. MultiSim of circuit exercise 2
9. AC Sweep exercise 2
10. Magnitude and Phase plot exercise 2
11. Circuit 3 for exercise 3
12. Equation for exercise 3
13. MultiSim of circuit exercise 3
14. AC Sweep exercise 3
15. Magnitude and Phase plot exercise 3
16. Circuit 4 for exercise 4
17. Equation for exercise 4
18. MultiSim of circuit exercise 4
19. AC Sweep exercise 4
20. Magnitude and Phase plot exercise 4
21. Circuit 5 for exercise 5
22. Equation for exercise 5
23. MultiSim of circuit exercise 5
24. AC Sweep exercise 5