

CMPE 460 Laboratory Exercise 7

Filter Design & Simulation

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Submitted: 3/25/2022

Lab Section: 2
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Lecture Section: 1
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By submitting this report, you attest that you neither have given nor have received any assistance (including writing, collecting data, plotting figures, tables or graphs, or using previous student reports as a reference), and you further acknowledge that giving or receiving such assistance will result in a failing grade for this course.

Your Signature: _____

Description

This lab work with LT-spice to design various active and passive filters. Higher order passive filters, Sallen-key, Butterworth, and Bandpass Bi-Quad filters were designed in LT-spice and simulated over certain input frequencies.

Schematics & Simulations

First Order Low Pass Filter

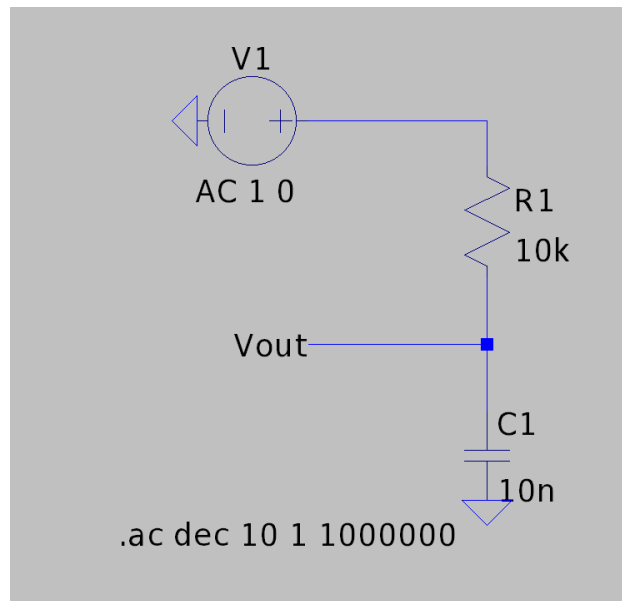


Figure 1: First-order Low Pass Filter circuit schematic.

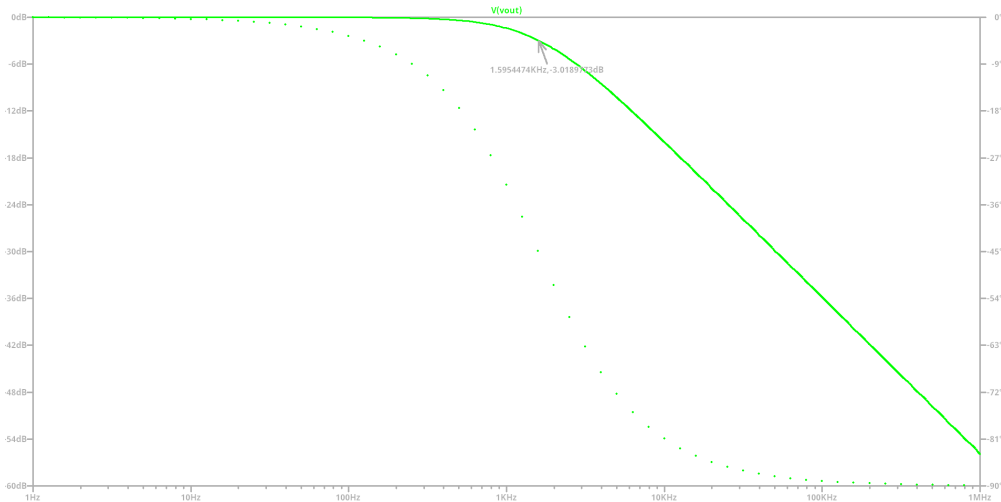


Figure 2: First-order Low Pass Filter LT-Spice simulation from 1 Hz to 1 MHz.

Second Order Low Pass Filter

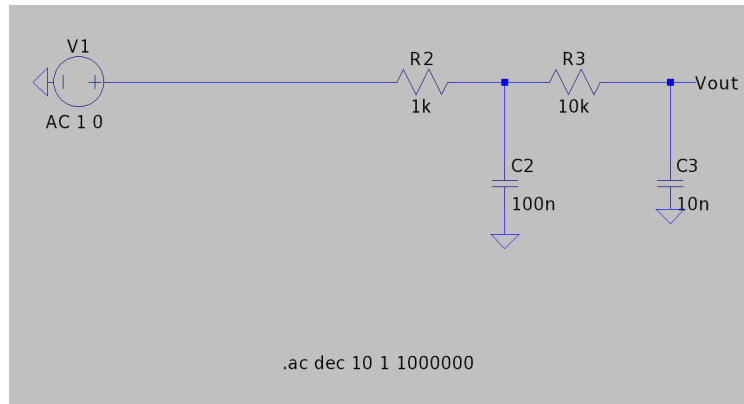


Figure 3: Second-order Low Pass Filter circuit schematic.

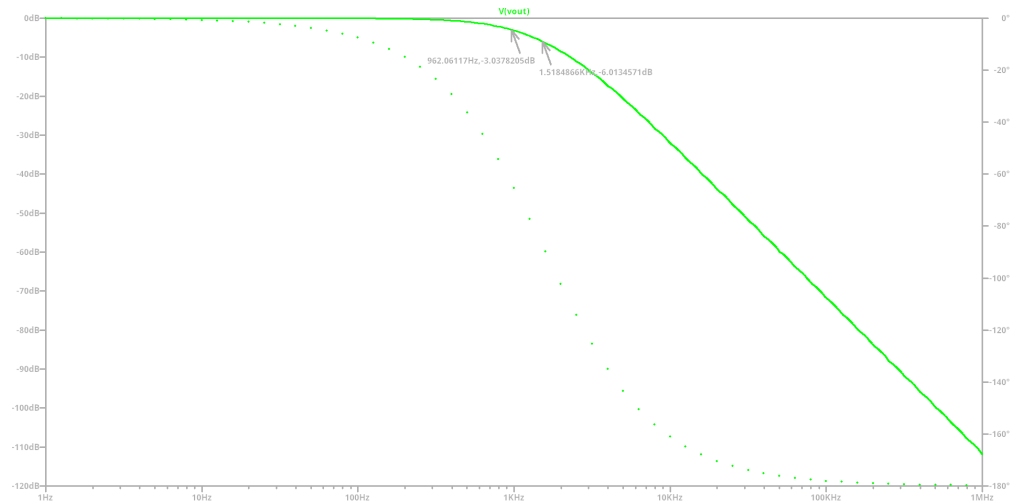


Figure 4: Second-order Low Pass Filter LT-Spice simulation from 1 Hz to 1 MHz.

Third Order Low Pass Filter

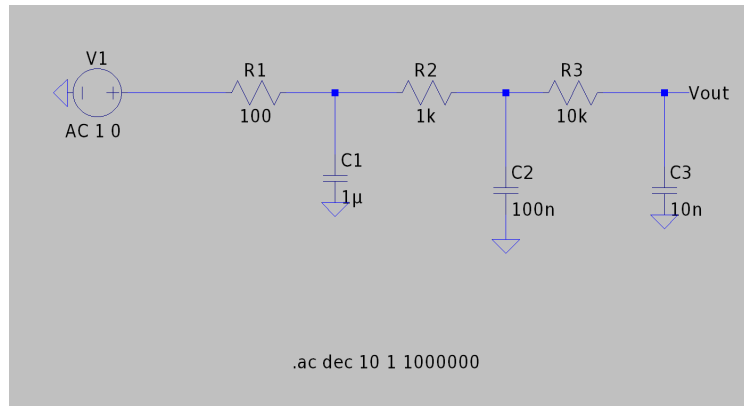


Figure 5: Third-order Low Pass Filter circuit schematic.

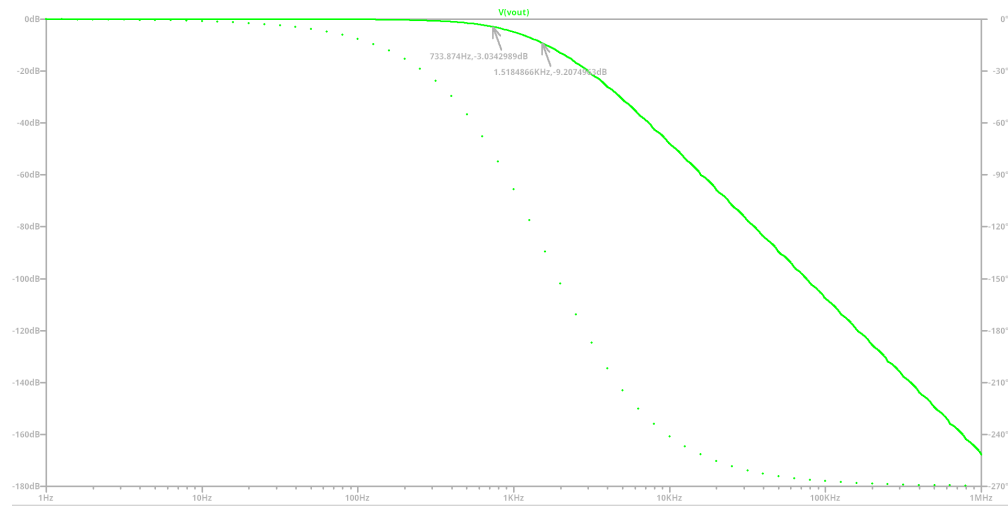


Figure 6: Third Low Pass Filter LT-Spice simulation from 1 Hz to 1 MHz.

First Order Low Pass Filter Parametric Sweep

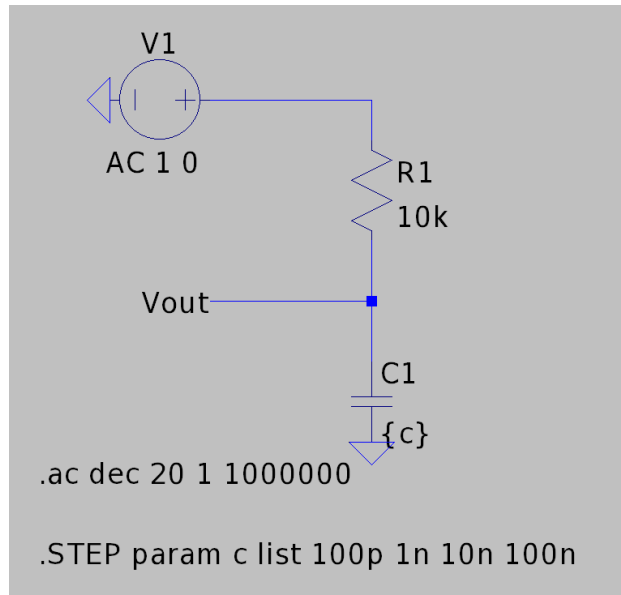


Figure 7: Parametric sweep of low pass filter capacitor circuit schematic

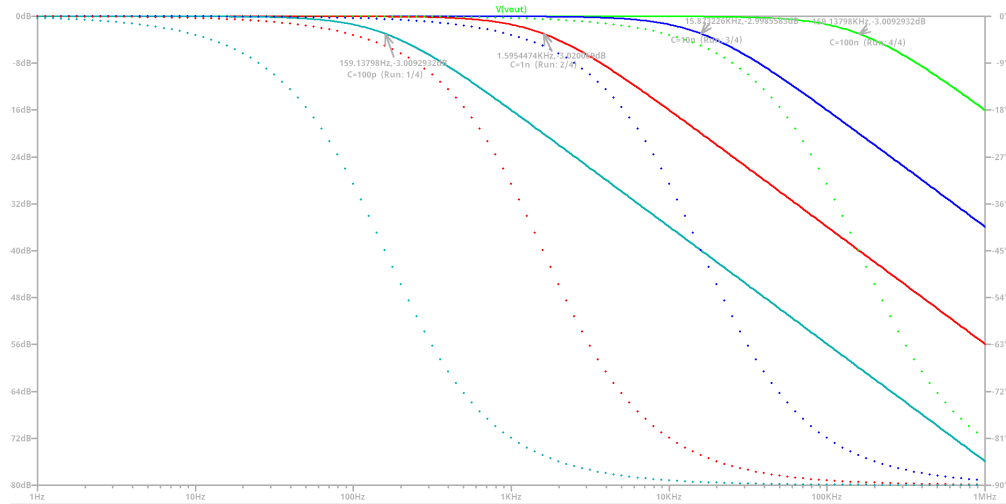


Figure 8: Parametric sweep of low pass filter capacitor LTSpice simulation from 1 Hz to 1 MHz.

Sallen-Key Low Pass Filter

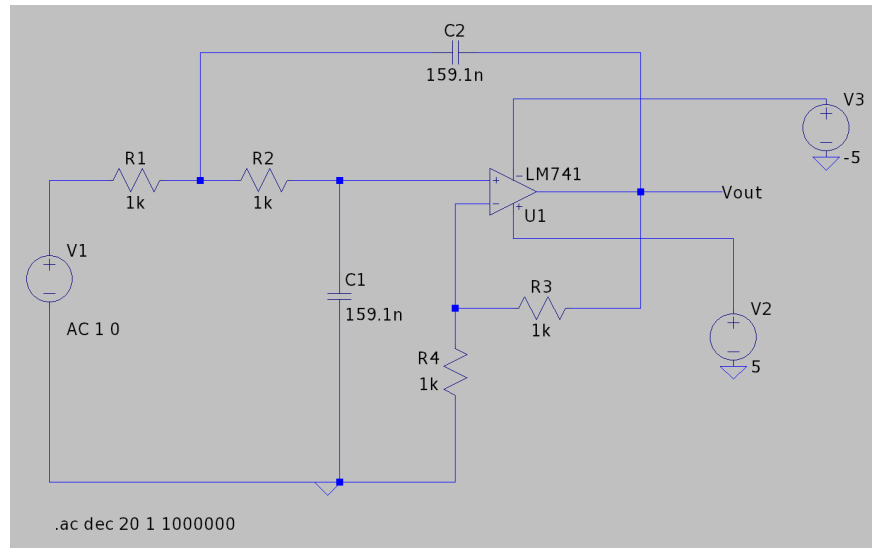


Figure 9: Sallen-Key Low Pass filter circuit schematic

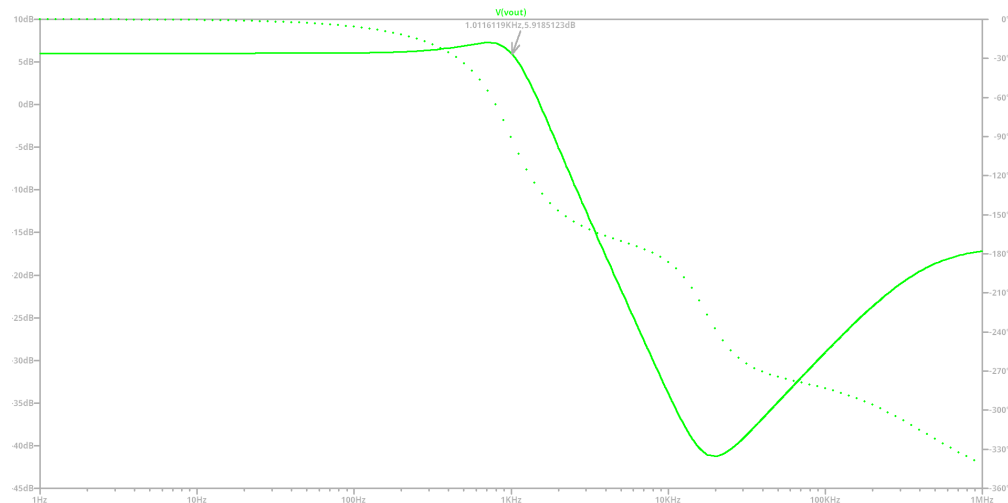


Figure 10: Sallen-Key Low Pass filter LT-Spice simulation from 1 Hz to 1 MHz.

Butterworth Low Pass Filter

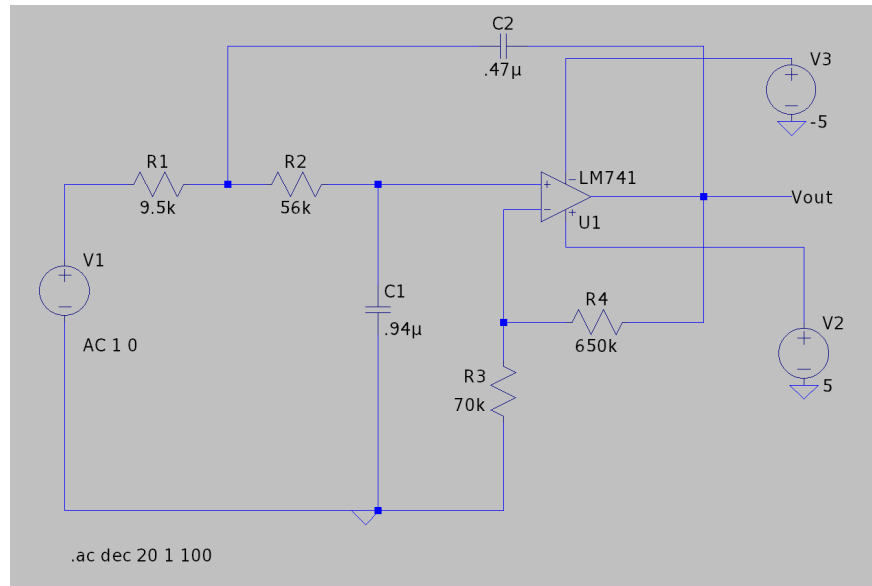


Figure 11: Butterworth Low Pass filter circuit schematic

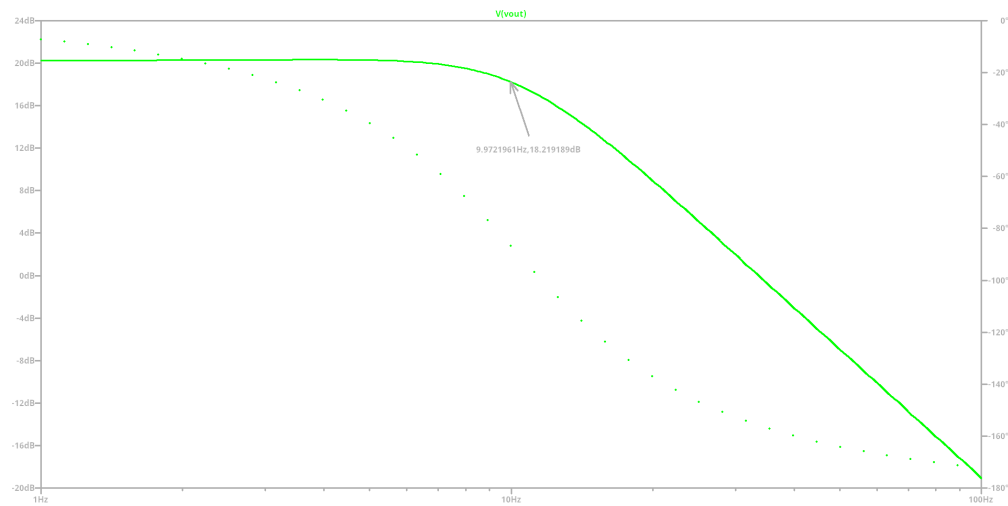


Figure 12: Butterworth LT-Spice simulation from 1 Hz to 1 MHz.

Bi-Quad Band Pass Filter

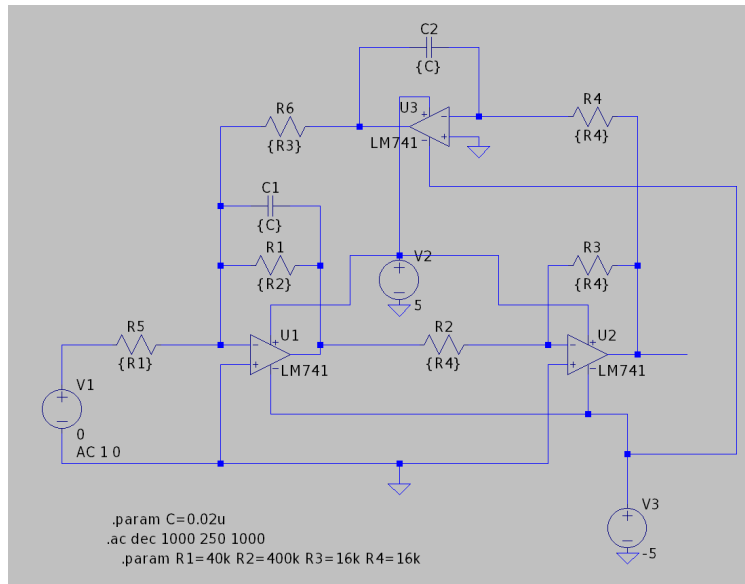


Figure 13: Bi-Quad Band Pass filter circuit schematic (K=10)

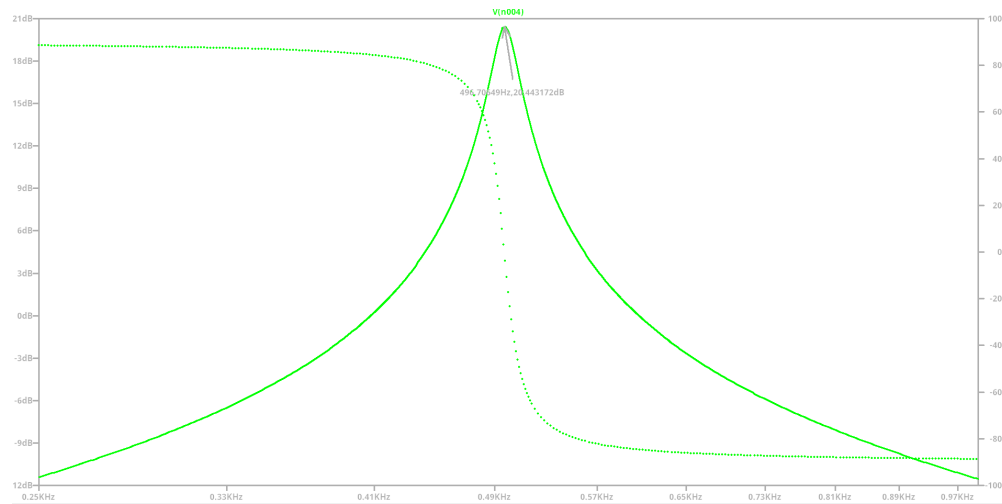


Figure 14: Bi-Quad Band Pass Filter LT-Spice simulation from 1 Hz to 1 MHz.

In-lab questions

1. What is the slope of each of the (straight line portion) of each magnitude plot curve?

-40 dB/decade

2. What would happen as more stages are added?

If more low pass filter stages were added, the linear portion would approach a vertical line (brick wall). Each extra stage adds -40 dB/decade to this slope.

3. Can you think of an ideal component/circuit to put between each stage?

A voltage follower can be used to completely isolate the input reactance of the filter stages from each other.

Exercise 7: Filter Design and Simulation

Student's Name: Andrei Tumber Section: 2

Demo		Point Value	Points Earned	Date
Demo	1st , 2nd, 3rd Order Passive Low Pass Filters	20	20	CP 3/18 dy 3/22
	LP Parametric Sweep	10	10	
	Butterworth Filter	20	20	
	BiQuad Filter	20	20	

To receive any grading credit students must earn points for both the demonstrations in addition to the Worksheet submission containing the Schematics/Plots/Question Answers.