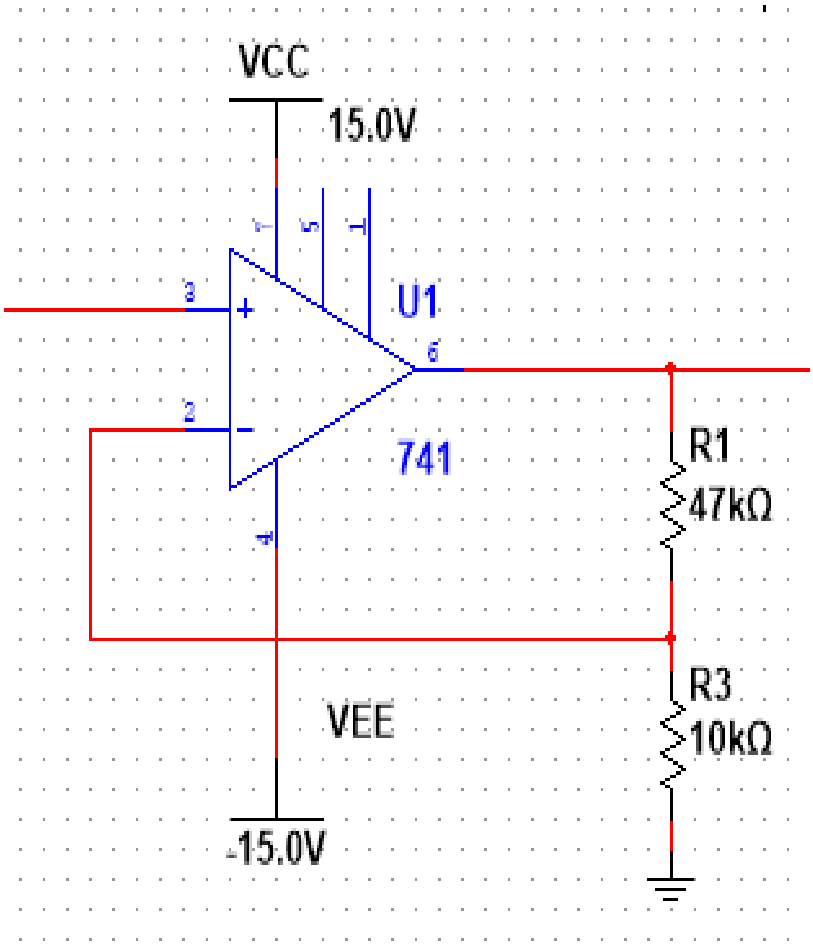


Active Filters

ECT226

Alisha T. Larkin | D41192340 | July 2023| 8/26/2023

Introduction

Objectives

- *Design Low Pass Filters*
- *Establish High Pass Filters for Examination*
- *Auto Mixer Output Filtering with Low Pass Filters*
- *Band Pass Filter Architecture and Evaluation*

Active Filters vs. Passive Filters

In modern enterprises tablets, smartphones, and laptops are the essence in the way the digital world engages with IoT devices. Communication, industrial control, and electronics use audio circuit (AC) and radio frequencies (RF) signals to function. Electronic signals are sensitive to interference and noise. A filter decreases and removes unwanted signal frequency. Resistor inductors (RL) and/or resistor capacitors (RC) forms filter circuits. Active filters are easy to design and operate on external dc sources. IC chip R and C are used along with operational amplifiers (op-amp) for the active filters. Comparing and contrasting active and/or passive filters, op-amps have a continued power source for active filter while passive filters power gain doesn't exceed beyond 1 resulting in no energy being generated. Passive filters rely on the individual power source of the input signal.

Difference between passive and active filters include:

- *Passive Filters - resistors, capacitors, inductors*
- *Active Filters - transistor, op-amps*

Active filters consist of:

- *Butterworth active filter*
- *Bessel filter*
- *Elliptical filter*

Passive filters consist of:

- *Band pass filters*
- *Band stop filters*
- *Low pass filters*

Components of passive filters can be expensive and hard to include into circuits due to inductors making the op-amp ideal. Outside sources are used when an active filter is in operation. Passive filters are without outside source to be functional. Active filters can also be passive filters increasing their filter gain with an op-amp amplifier.

Procedures and Results

1. Answer the following question: Why is the frequency response shown in Figure 2.1 that of a high pass filter? (Part 2, step 1). *Filters begin at the cutoff frequency fc and the filter rate is indicated in the slope of a bode plot measuring gain (decibel dB). Figure 2.1 implies the pass band and stop band mark the filter within high frequency. Due to high frequencies, the active circuit inverts amplifier with voltage gain of* $-R_f/R_s$.

2. Calculate f_c and A_{CL}. Enter the values in Table 2.1 (Part 2, step 4).

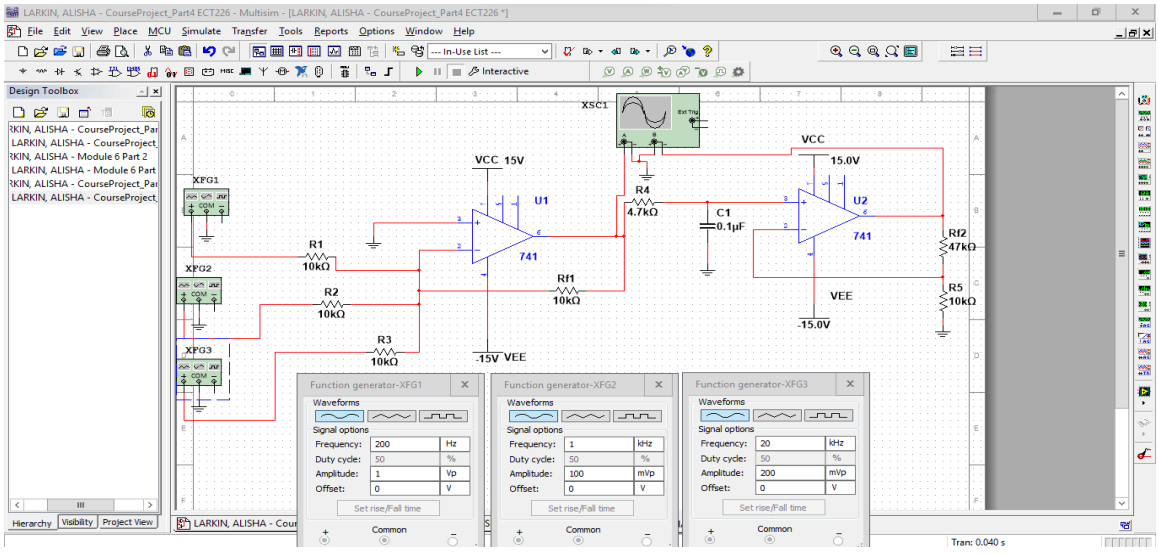
Table 2.1

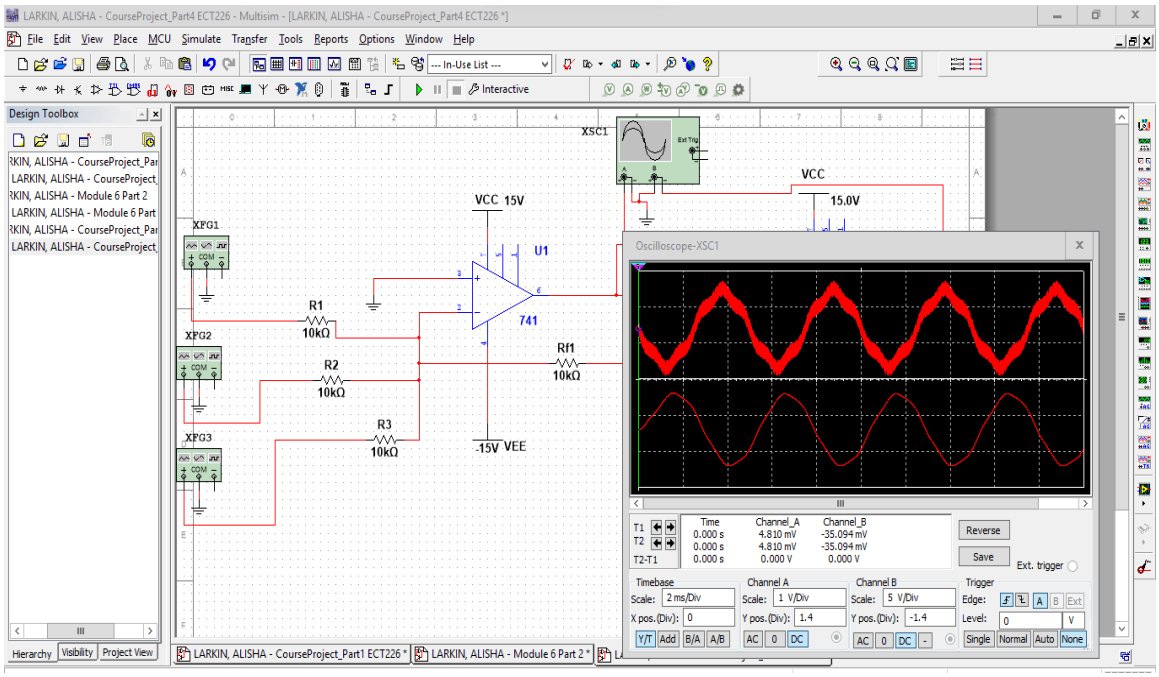
Calculated f_c (kHz)	Calculated A_{CL} @ pass band	Calculated A_{CL}(dB) @ pass band
$f_c = \frac{1}{2\pi R_1 C_1} = 338.6$	$A_{CL} = 1 + \frac{R_{f1}}{R_{f2}} = 5.7$	$A_{CL}\,(dB) = 20 \log A_{CL}\,(5.7) = 15.1$

3. Measure f_c and A_{CL}(dB). Enter the values in Table 2.2. (Part 2, step 9).

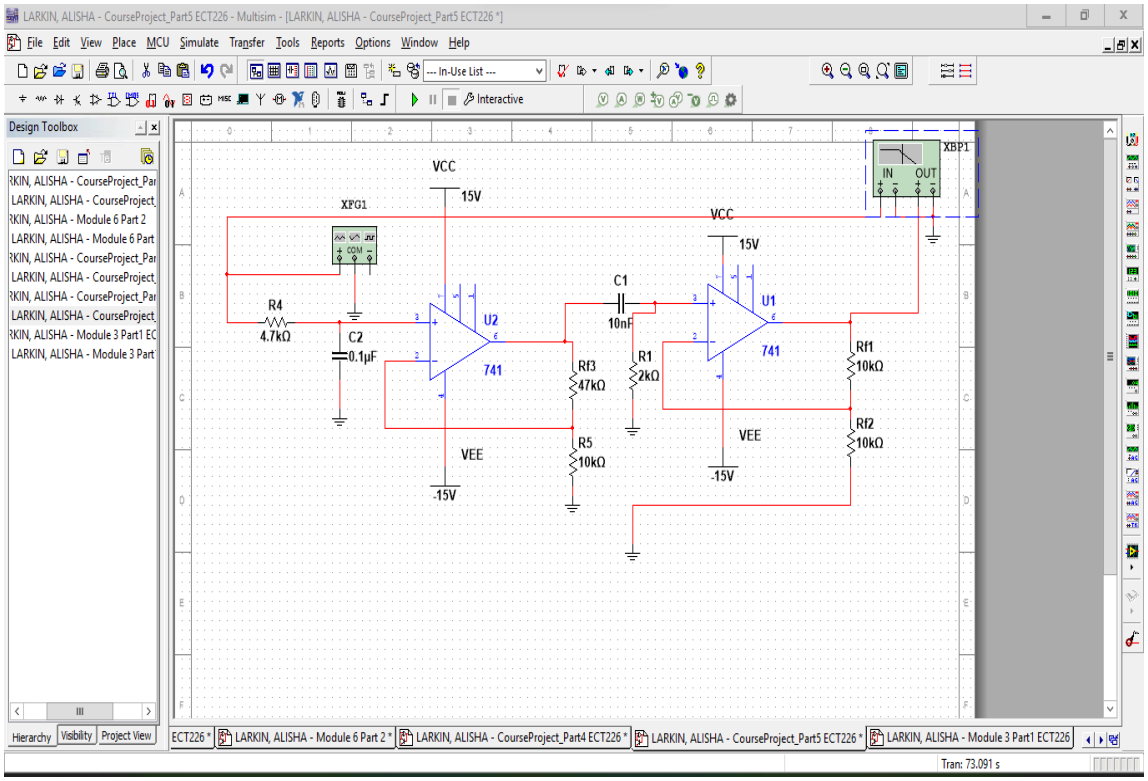
Table 2.2

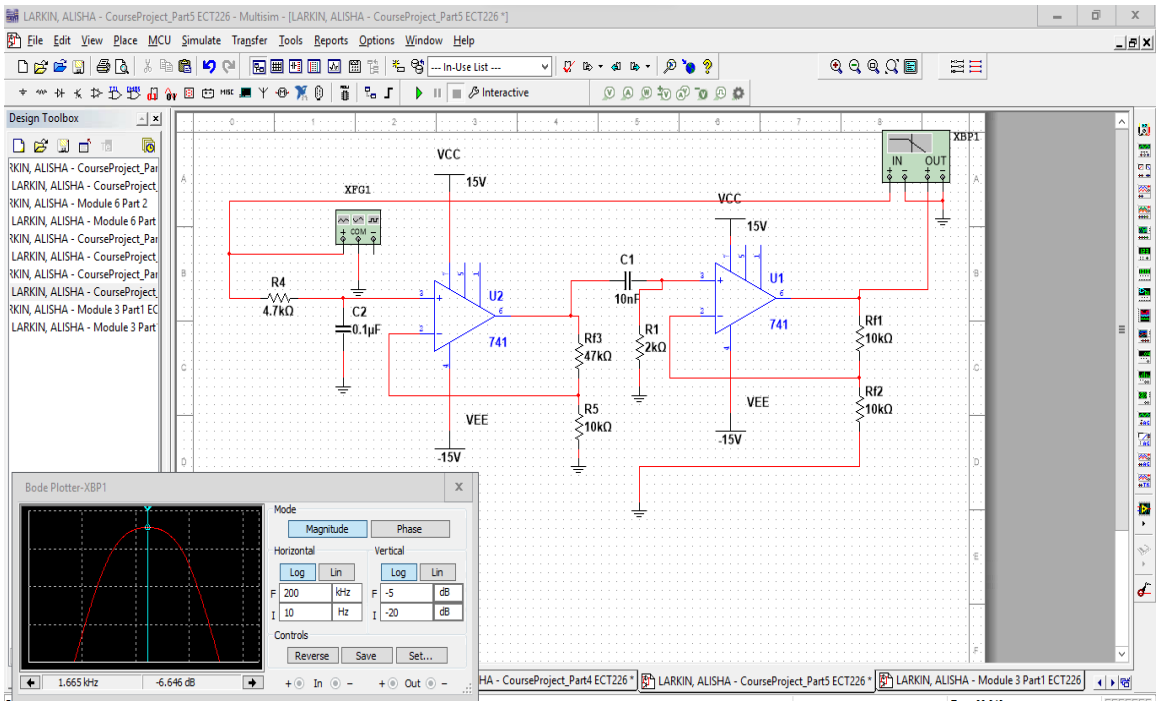
Simulated A_{CL}(dB) @ pass band*	Simulated f_c (kHz)
2.927	***7.881***





4. Answer the following questions (Part 3, step 6):
   a) Explain what you see at the output of the low pass filter. *Blocking high frequency transmission signals.*
   b) Which frequency component(s) are filtered out. *High frequencies are filtered out due to the low filter removing frequency.*
   c) Why is the low pass filter removing the frequency component(s)? *A low pass filter removes the frequency of noise components to provide better transmission of signal.*





5. Measure f_{cl} and f_{ch} from the simulation. Fill in the values in Table 4.1 (Part 4, step 5).

Table 4.1

Measured f_{cl} (Hz)	Measured f_{ch} (kHz)
10	**1.665**

Conclusion

What I learned in Electronic Device and System Foundations (ECT226) final course project was how to design high pass filters, band pass filter, and low pass filters using RC and RL circuits. Troubleshoot filters using Multisim, in addition, evaluate frequency responses. Problems I encounter while working on the project was the Multisim application decreased loading time while saving the project. Encounter problems were solved with time management.

References

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