EE100B Lab Report #6: Design of Active Bandpass Filters

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Section 21

Abstract

The goal of this lab is to familiarize ourselves with the design of Active Bandpass Filters. We will do this by designing and recording data from a bandpass filter.

Procedure

Begin by calculating Am using formulas : Am = g/(9-2g)

Q = 3/(9-2G) and then calculate the reset of the unknown values needed for the circuit with the

$$H(s) = \frac{RC\left(1+\frac{R_5}{R_4}\right)s}{R^2C^2s^2 + RC\left(7-2\frac{R_5}{R_4}\right)s+9}$$

following formulas. G = 1 + R5/R4 Fc = 1/ 2piRC .

From here use MATLAB to create a plot of the magnitude and phase response using the information found. From here construct the circuit using the calculated information and run a simulation with a sine (0 10 5) to start filling out the table. Change the value of the 10 according to the table frequencies to fill out the rest of the table. From here create a plot based off the table values.

Analysis

Am = g/(9-2g)

Q = 3/(9-2G)

G = 3

Am = 1

G = 1 + R5/R4

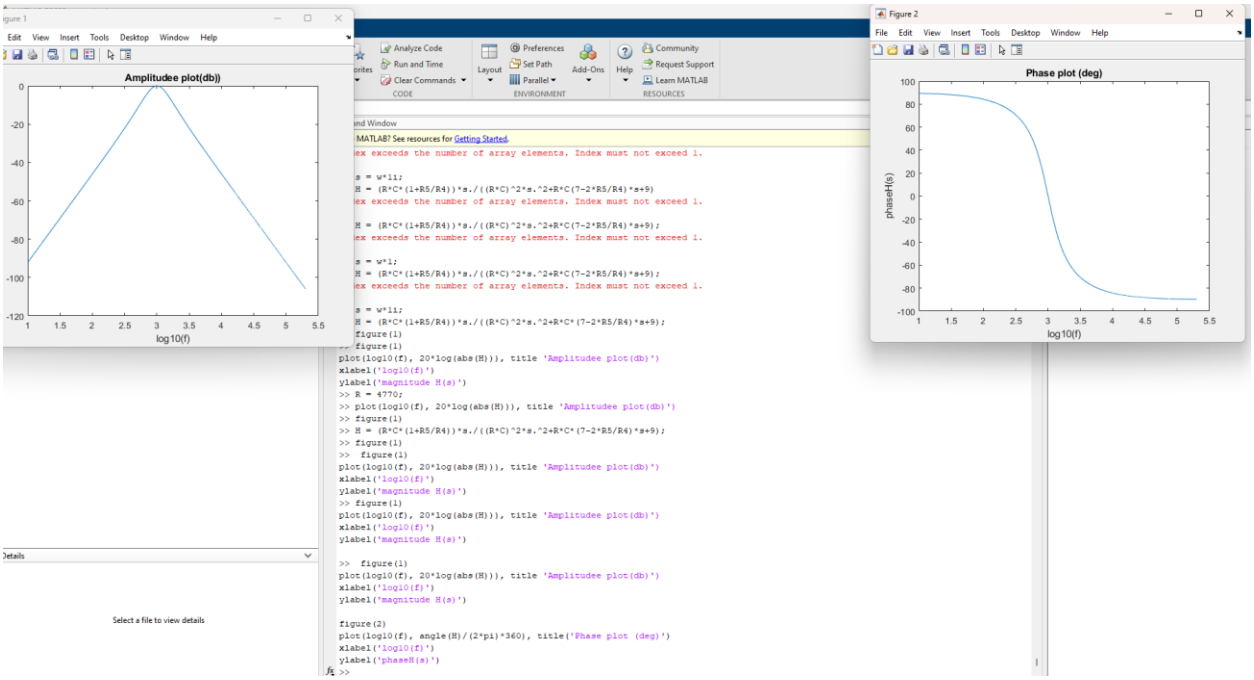
R4 = 500

Fc = 1/ 2piRC

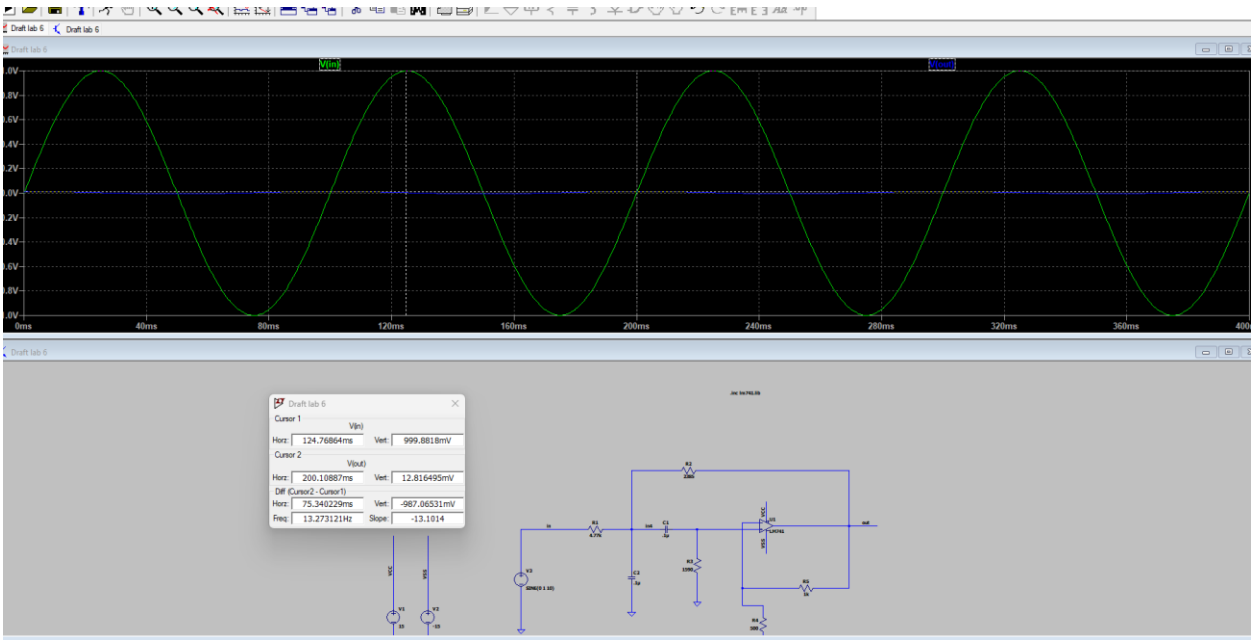
R = 4.77k

$$H(s) = \frac{RC\left(1+\frac{R_5}{R_4}\right)s}{R^2C^2s^2 + RC\left(7-2\frac{R_5}{R_4}\right)s+9}$$

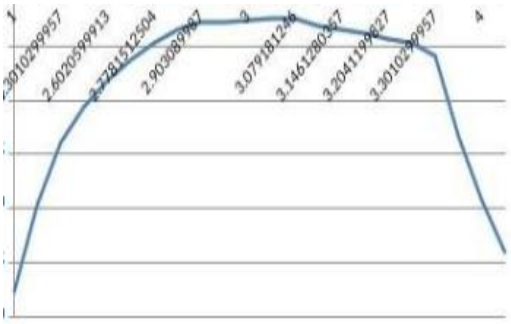
H(s) = .33

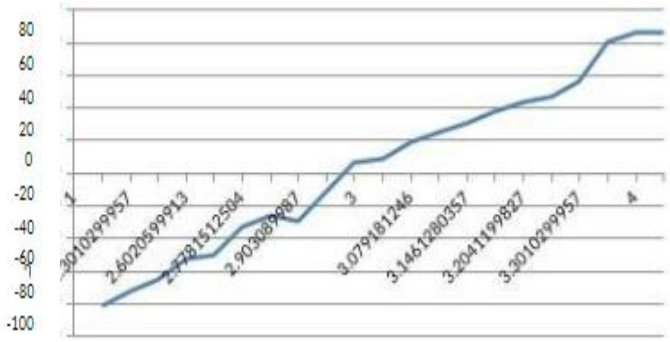


The picture above is the plot of the formula calculations that are required by part 1 of the lab report. The bottom image is the setup for the circuit with the calculated numbers and the first numbers for the table info.



f, HZ	VAC_OUT	VAC_IN	PHASE	GAIN	GAIN	PHASE	Log(f)
10	28	689	na	.0406	-28	Na	1
100	76	720	-2.24	.105	-19.4	-80	2
200	146	715	-1	.202	-13.9	-70	2.2
300	209	710	-.5	.296	-10.6	-65	2.5
400	282	713	-.35	.394	-8.1	-51	2.6
500	350	708	-.26	.488	-6.2	-50	2.7
600	410	709	-.14	.584	-4.5	-32	2.8
700	478	709	-.1	.677	-3.4	-25	2.8
800	510	708	-.1	.723	-2.8	-29	2.9
900	520	706	-.03	.729	-2.7	-11	3
1000	522	708	.02	.739	-2.6	7.2	3
1100	534	702	.02	.750	-2.5	10	3
1200	527	705	.04	.750	-2.5	19	3.1
1300	490	708	.05	.694	-3.2	25	3.1
1400	472	708	.06	.667	-3.4	31	3.1
1500	450	709	.07	.641	-3.8	38	3.2
1600	434	705	.08	.614	-4.2	43	3.2
1700	410	705	.08	.584	-4.7	47	3.2
2000	360	708	.08	.505	-5.9	56	3.3
5000	150	707	.05	.215	-13.4	81	3.7
10000	77	705	.02	.109	-19.3	86	4
20000	45	708	.01	.062	-24.1	86	4.3





These 2 pictures are the gain and phase graphs required at the end of the lab based off the table entries. This is using excel instead of MATLAB since MATLAB is not my strong suit.

Problems

A couple of issues occurred during the lab. One issue is when I tried to put in the opAmp. The method of .inc opamp.lib was not working so I decided to find it online however im not sure if I got the right one, this might have lead to some inaccuracies in the values. The second issue is the plots on excel might not be accurate because although I know excel better than MATLAB I still am not proficient, Other than that the I am confident in the data.

Conclusion

The lab was successful in getting us familiar with designing Active Bandpass filters. There were a couple of hiccups with the setup but overall the goal was met. The lab was again not difficult to follow and easy to complete.