EE230: Lab 7
Active filters

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March 13, 2022

1 Overview of the experiment

1.1 Aim of the experiment

To perform in-lab experiments for plotting the Sallen-Key Active low pass, high pass and band pass filter and find the cutoff frequency.

1.2 Methods

1.2.1 Active Low Pass High pass filter

Sallen-Key is a second-order(two pole). Its also known as Voltage-controlles voltage source filter which happens to be a low-pass filter and high-pass filter based on the configuration of R and C where filter is of Butterworth. One RC circuit consits of R_A and C_A, and the second circuit consits of R_B and C_B.
One feature of this type of filter is that the capacitor C_A provides feedback for shaping the response near the edge of the passband

Figure 1: Lowpass Filter

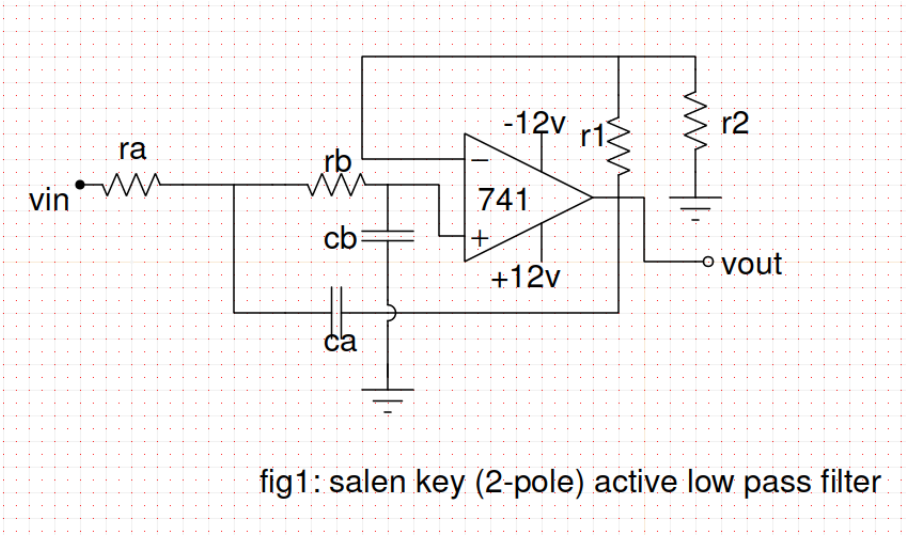


fig1: salen key (2-pole) active low pass filter

Figure 2: Highpass Filter

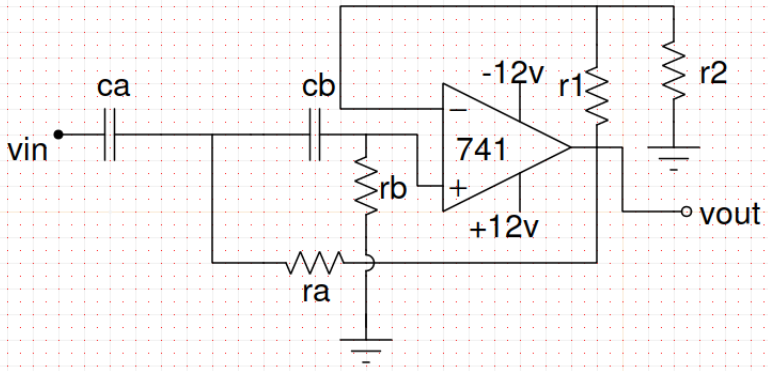


fig2:saln key (2-pole) active high-pass filter

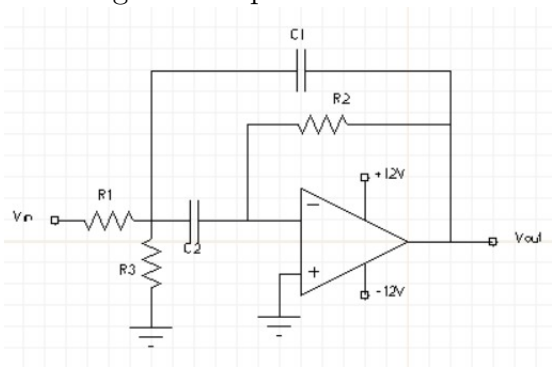
Critical frequency is given by $f_c = \frac{1}{2\pi\sqrt{R_A R_B C_A C_B}}$
But as $R_A = R_B$ and $C_A = C_B$, hence, $f_c = \frac{1}{2\pi RC}$

1.3 Multiple-feedback Active Band-Pass Filter

Multiple-feedback band-pass filter has two feedback paths through R_2 and C_1. Components R_1 and C_1 provide the low-pass response, and R_2 and C_2 provide the high-pass response, the maximum gain A_o which occurs at the center frequency whose expression is recorgnised as R_1 and R_3 in parallel combination with C_1 feedback path, so $f_o = \frac{1}{2\pi\sqrt{(R_1||R_{3)R_2C_1C_2}}}$,

but $C_1 = C_2 = C$, hence $f_o = \frac{1}{2\pi C}\sqrt{\frac{R_1+R_3}{R_1R_2R_3}}$.

Figure 3: Equivalent Circuit



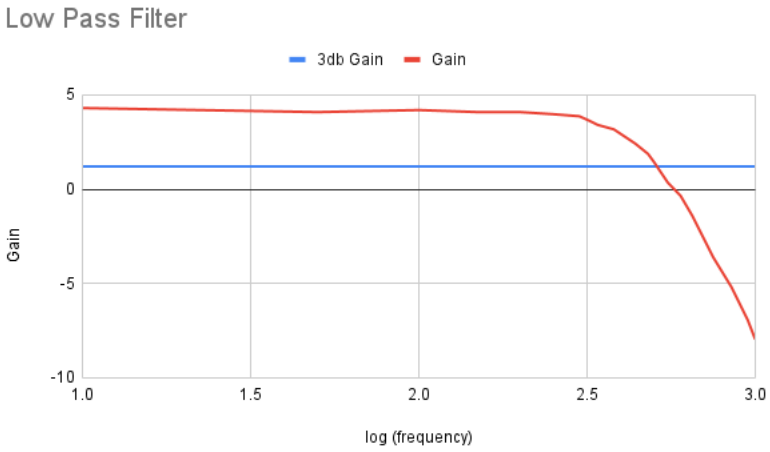
2 Experimental Results

2.1 Active Low pass

Figure 4: Lowpass Filter Data

Gain	Frequency
1.64	10
1.6	50
1.62	100
1.6	150
1.6	200
1.58	250
1.56	300
1.52	320
1.5	330
1.48	340
1.44	380
1.32	440
1.24	480
1.18	500
1.12	520
1.04	550
0.96	600
0.85	650
0.66	750
0.55	850
0.45	950
0.4	1000

Figure 5: Lowpass Filter Plot

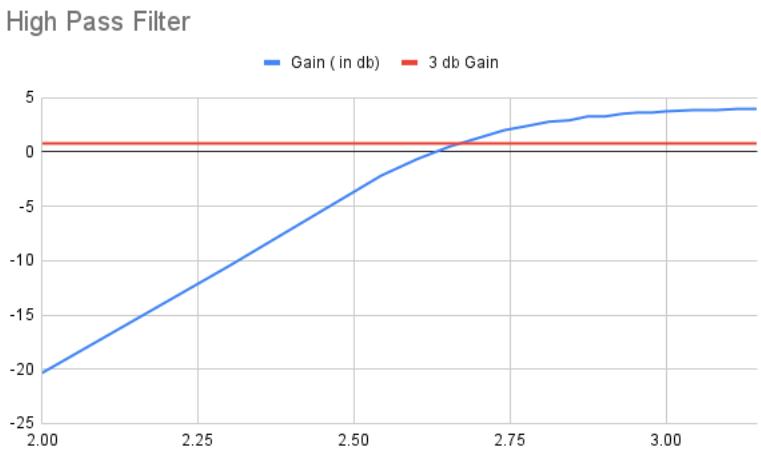


2.2 Active High pass

Figure 6: Highpass Filter Data

Gain	Frequency (in Hz)	
0.096	100	
0.3	200	
0.78	350	
0.93	400	
1.06	450	
1.12	480	
1.16	500	
1.2	520	
1.26	550	
1.32	600	
1.38	650	
1.4	700	
1.46	750	
1.46	800	
1.5	850	
1.52	900	
1.52	950	
1.54	1000	
1.56	1100	
1.56	1200	
1.58	1300	
1.58	1400	

Figure 7: Highpass Filter Plot

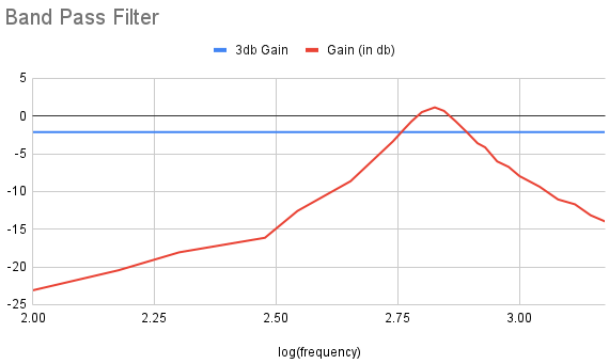


2.3 Band-pass

Figure 8: Bandpass Filter Data

Gain	Frequency (in Hz)
0.07	100
0.095	150
0.125	200
0.156	300
0.235	350
0.37	450
0.68	550
0.82	580
0.92	600
1.06	630
1.1	650
1.14	670
1.08	700
0.92	740
0.78	780
0.66	820
0.62	850
0.5	900
0.46	950
0.4	1000
0.34	1100
0.28	1200
0.26	1300
0.22	1400
0.2	1500

Figure 9: Bandpass Filter Plot



3 Experiment Completion Status

All required parts completed
Parts :
1. Active Low-pass filter
2. Active High-pass filter
3. Active Band-pass filter