

Physics 320 - Fall 2017
LAB 6 - A Bandpass Filter and a Butterworth Filter

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To Turn In: Photocopies of your lab notebook pages for the lab. For Part 1, you need to show a *theoretical calculation*¹ of $\mathbf{H}(j\omega)$ and the Bode plots of your measurements, i.e. $V_{\text{out}}/V_{\text{in}}$. The Bode plot should have both the theoretical curve and the actual data. For Part 2, you do not need to produce a theoretical calculation but you do need to make a Bode plot of $V_{\text{out}}/V_{\text{in}}$. You should use a computer to make your plots and then print them out and tape them into your lab notebook in the appropriate places.

Part 1 - Bandpass Filter

Construct the bandpass filter below with $C_1 = 0.1 \mu\text{F}$, $C_2 = 100 \text{ pF}$, $R_1 = 2 \text{ k}\Omega$, and $R_2 = 100\text{k}\Omega$. Measure its voltage response as a function of frequency. Remember to also measure the phase response. Be sure you can find the -3 dB points. Please note: you can think of this circuit as two circuits, a high pass filter connected to a low pass filter. The input of the low pass filter is the output of the high pass filter.

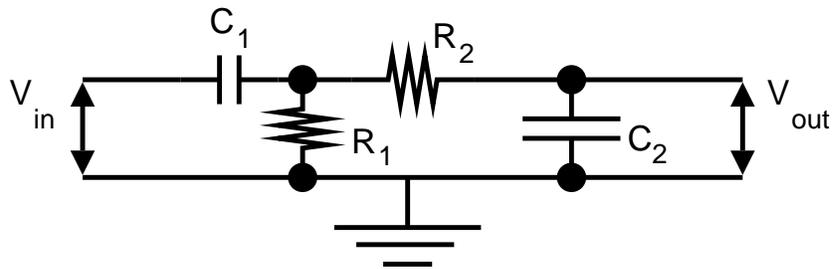


Figure 1: Bandpass Filter

¹This is a detailed, concise calculation showing the step-by-step analysis of the circuit.

Part 2 - The Butterworth Filter

Construct the “5-pole” Butterworth filter shown below with $L_1 = L_2 = 10$ mH, $C_1 = C_3 = 0.01$ μ F, $C_2 = 0.033$ μ F, $R_1 = 560$ Ω , and $R_2 = 620$ Ω . Again measure its voltage response as a function of frequency. You need not measure the phase response. You may notice some oscillations in output amplitude at lower frequencies. Also, be attentive to the reduced amplitude at all frequencies. *Check this circuit with V_{in} being purely DC using the power supply, not the function generator.*

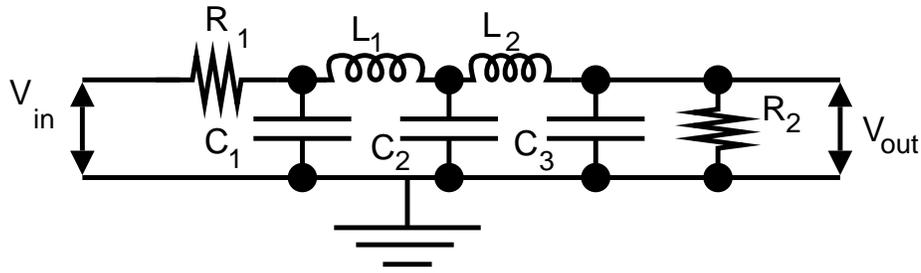


Figure 2: Butterworth Circuit