

Electronics Lab 3: Pass Filters

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The purpose of this lab was to construct a high and low pass filter with a cut off frequencies of 1 kilohertz.

I. INTRODUCTION

The purpose of this exercise is to explore simple circuits which have both resistors and capacitors in them. These circuits, it will be seen, act as filters.

II. THEORETICAL MODEL

The cut off frequency of the pass filters is given by the equation:

$$f_c = \frac{1}{2\pi RC} \quad (1)$$

So using this equation, we can plug in a capacitance and solve for the required resistance or vice versa for a cut-off frequency of 1 kilohertz, then construct the relevant required circuit. The gain for the circuit is given by

$G = V_{\text{out}}/V_{\text{in}}$, and then the bode plot is the $\log(f)$ vs. $20 \log(G)$ which is the DC conversion for the bode plot.

III. EXPERIMENT

The pass filters were simple RC circuits, set up according to the diagram. The experimental data is in blue, and the expected values are in red. The resistor used was 1068Ω , and the capacitor is $0.15 \mu\text{f}$.

A. Data

IV. CONCLUSION

For each of the following instances, the High and Low Pass Gains and Bode Plots closely followed the model. The plot with the most amount of error was the Relative Phase plots, however this is likely due to the difficulty of manual measurements when the waves are close together. I acknowledge the support of the Wabash College Physics Department.

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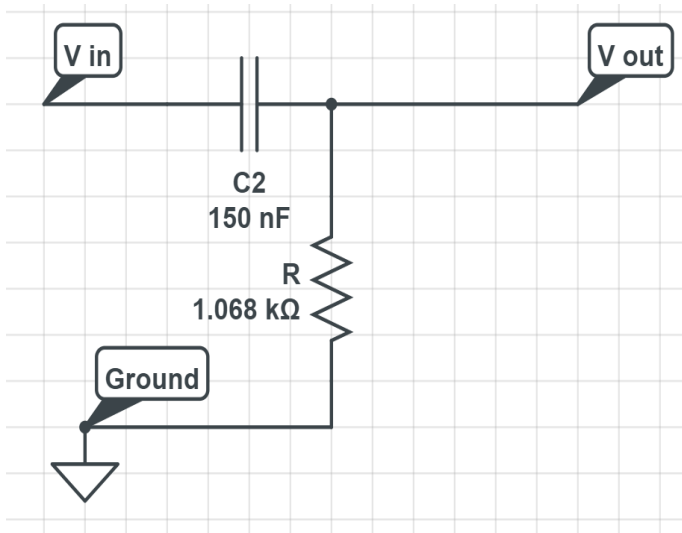


FIG. 1. High Pass Filter

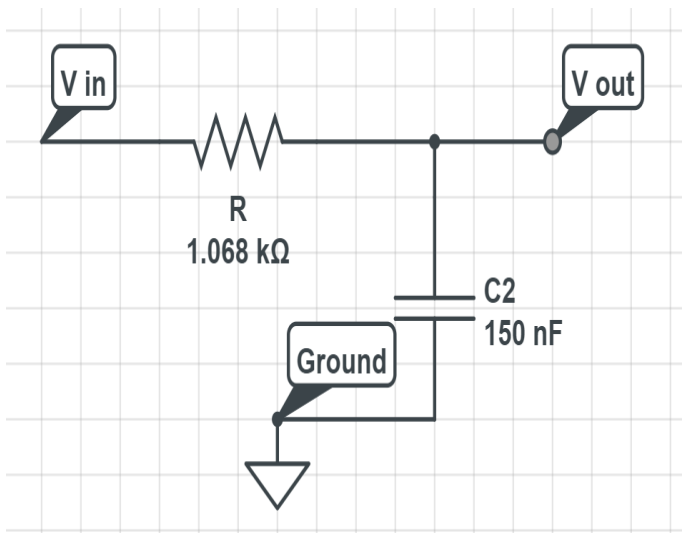


FIG. 2. Low Pass Filter

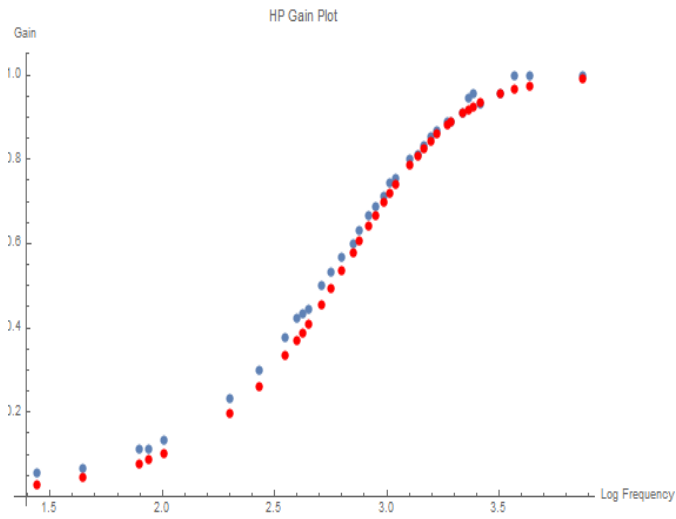


FIG. 3. High Pass Gain Plot

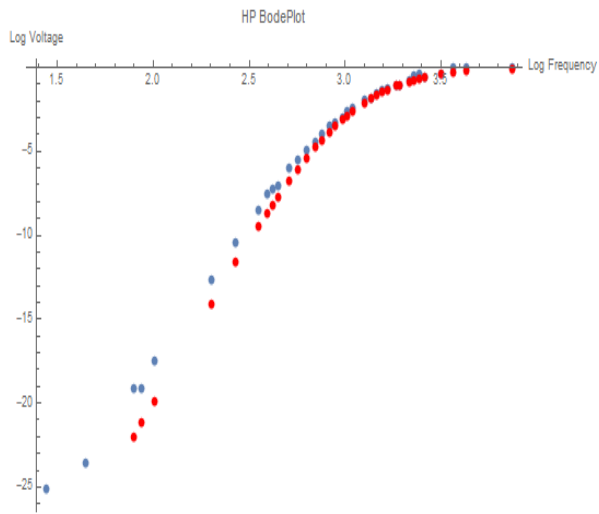


FIG. 4. High Pass Bode Plot

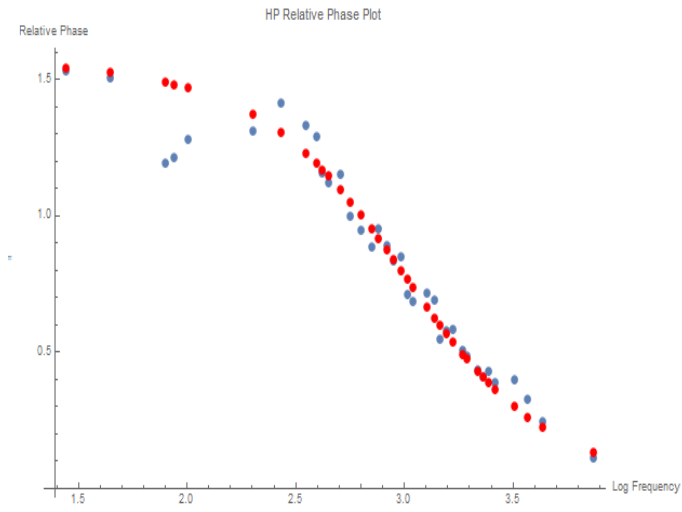


FIG. 5. High Pass Relative Phase Plot

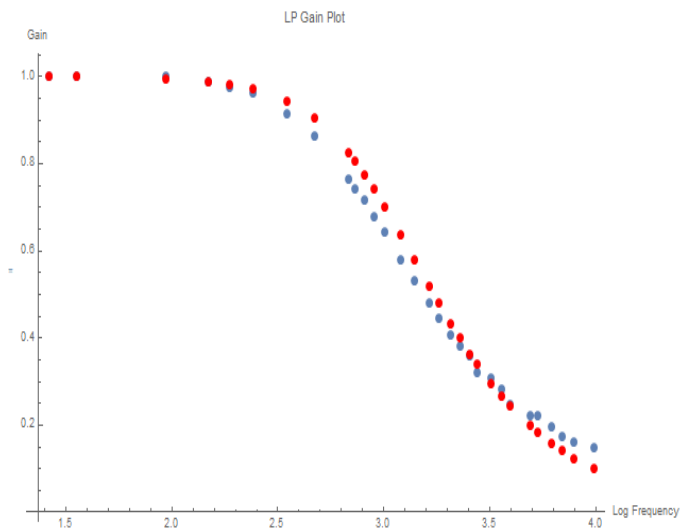


FIG. 6. Low Pass Gain Plot

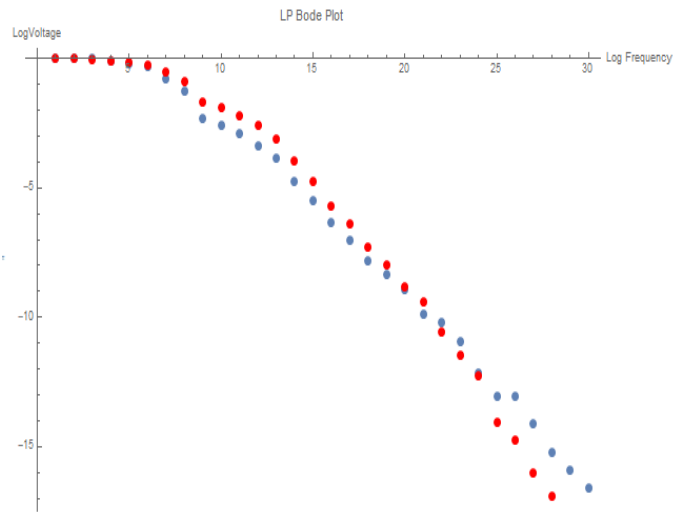


FIG. 7. Low Pass Bode Plot

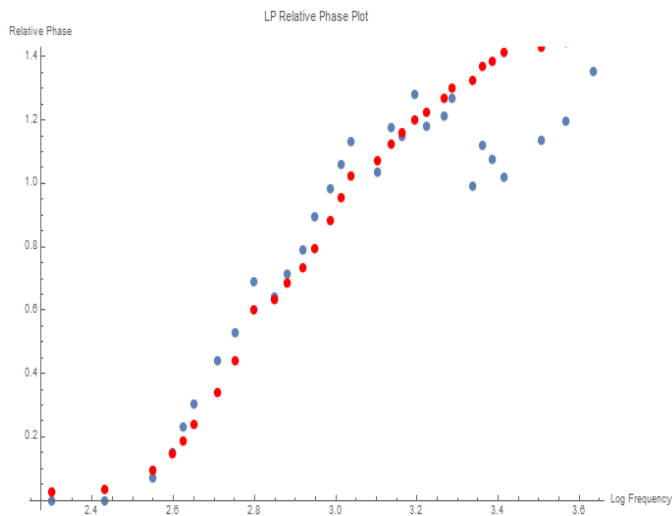


FIG. 8. Low Pass Relative Phase Plot