Lab 05 Report
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EE 316

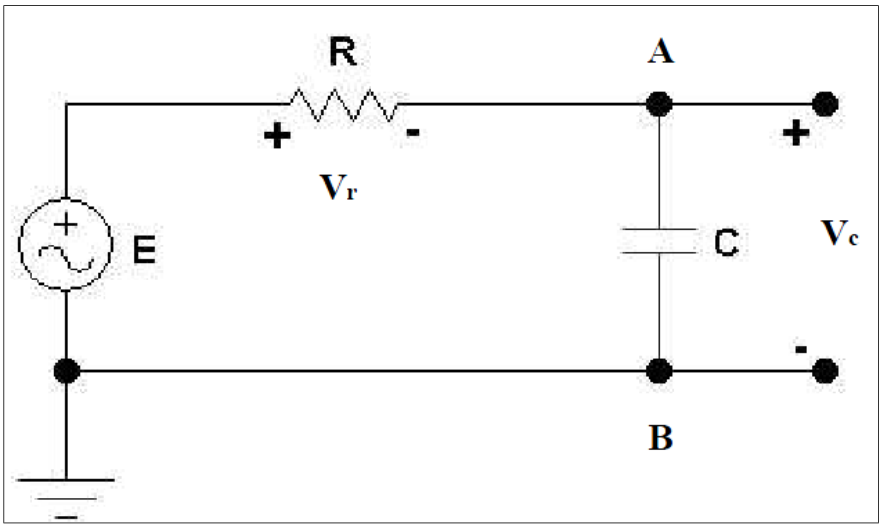
Basic Filters and Frequency Response

Simulation

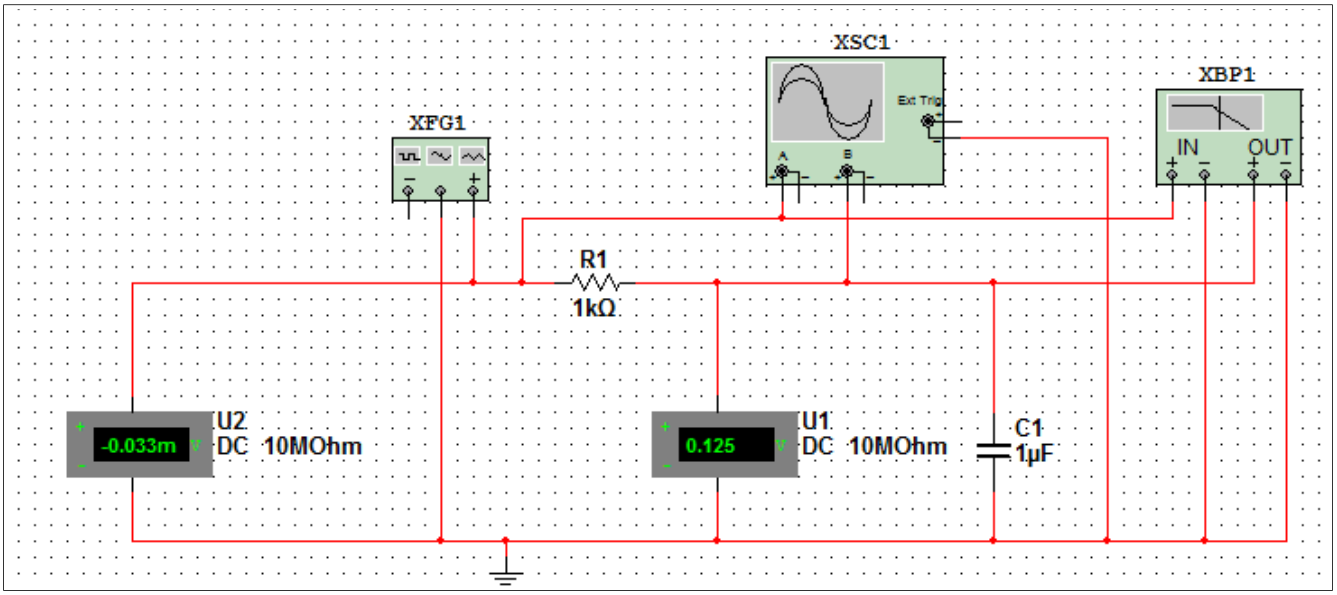
In this lab we will be modeling both low pass and high pass filters. The filter design (RC) is excellent for analyzing the connection between formulas and implementation, as there are no ICs involved. Low pass filters make sense, as the capacitor will easily oscillate to absorb high frequencies when placed in parallel with the input. High pass filters put the capacitor in series with the source, where low frequencies are killed by the saturation of the capacitor. The generic filter circuits are listed below, along with simulation results.

Simulation – Low Pass

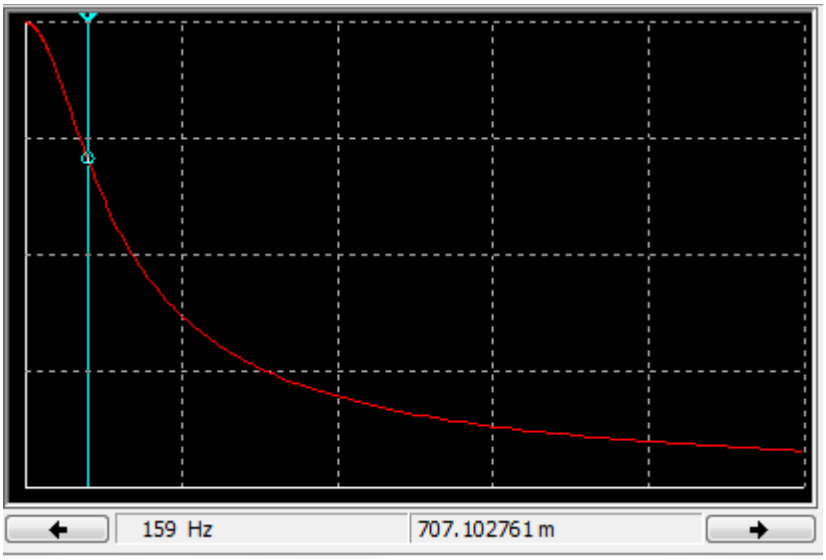
Model



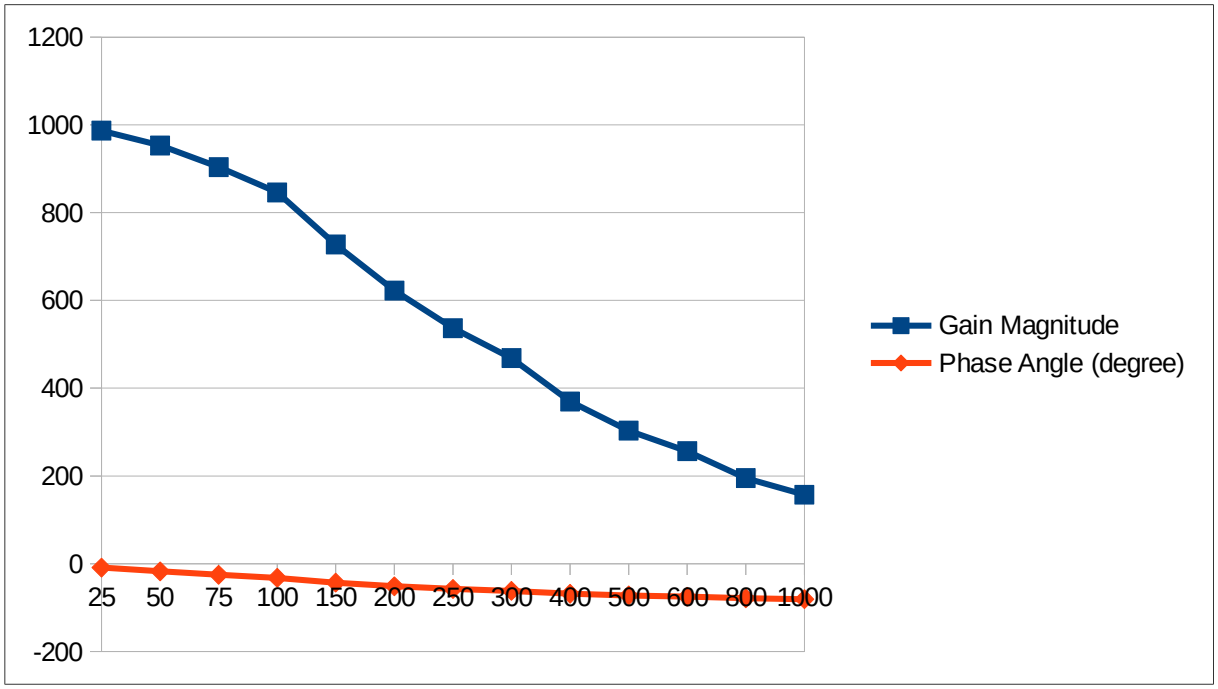
Circuit



Bode



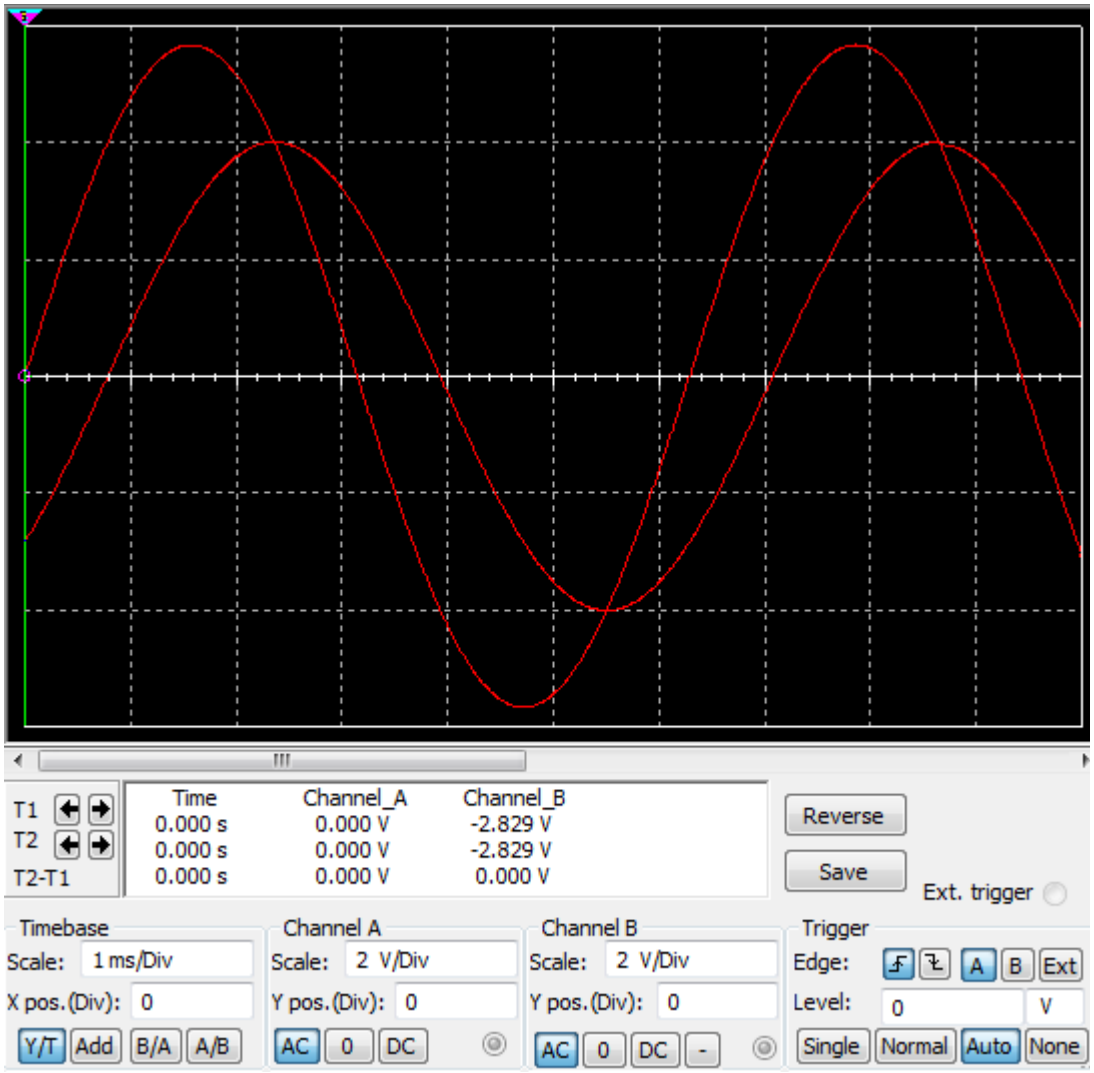
Results



Data

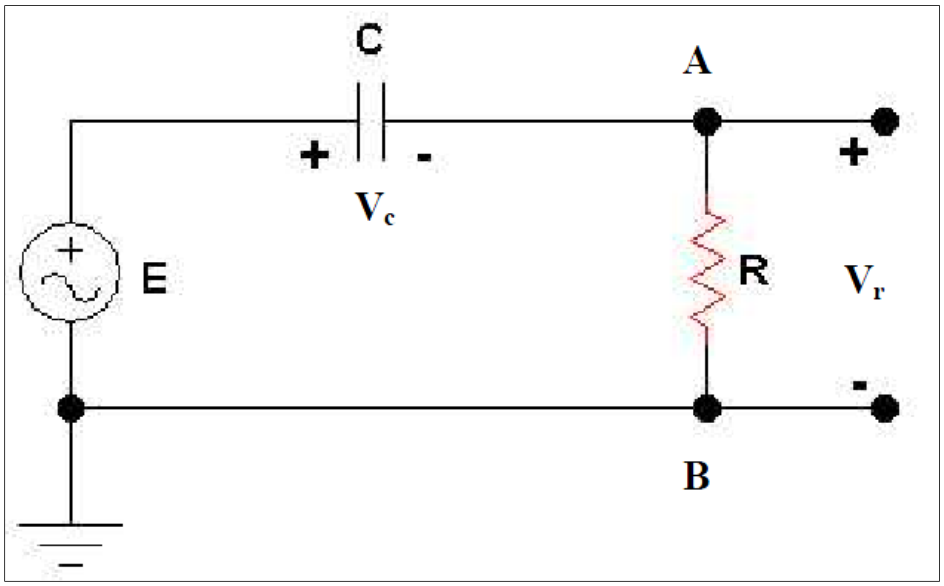
Frequency (Hz)	Gain Magnitude	Phase Angle (degree)
25	986.923	−8.918
50	953.159	−17.424
75	903.847	−25.209
100	846.126	−32.116
150	727.351	−43.274
200	622.443	−51.459
250	536.893	−57.491
300	468.573	−62.028
400	369.669	−68.282
500	303.298	−72.326
600	256.391	−75.129
800	195.132	−78.736
1000	157.173	−80.948

Oscilloscope

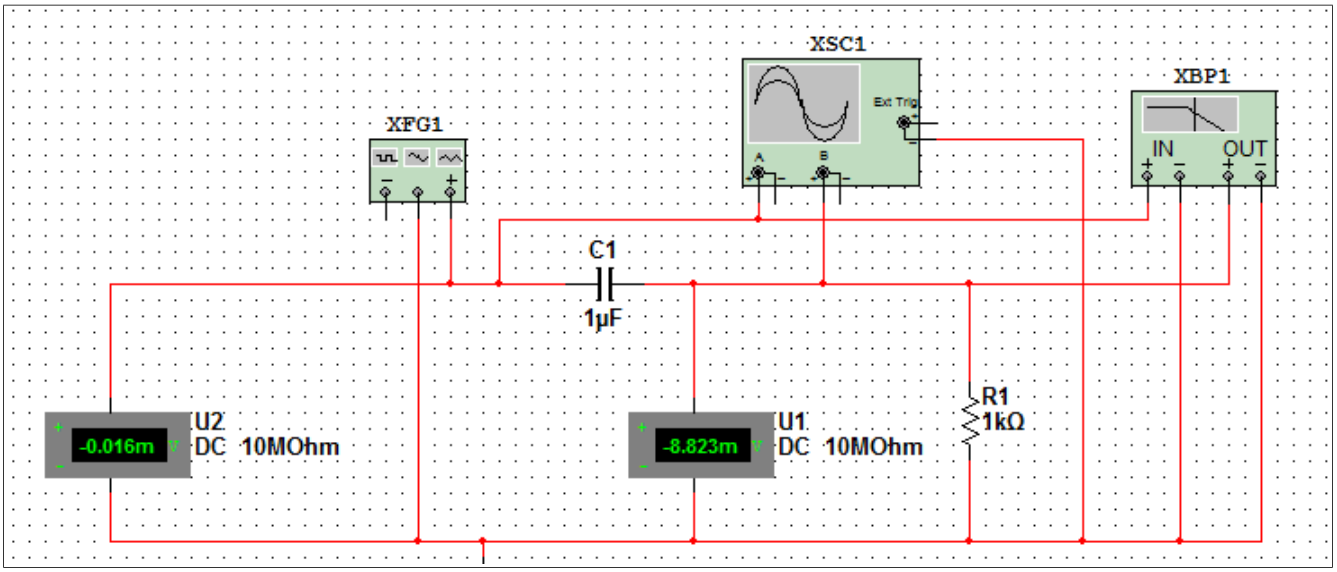


Simulation – High Pass

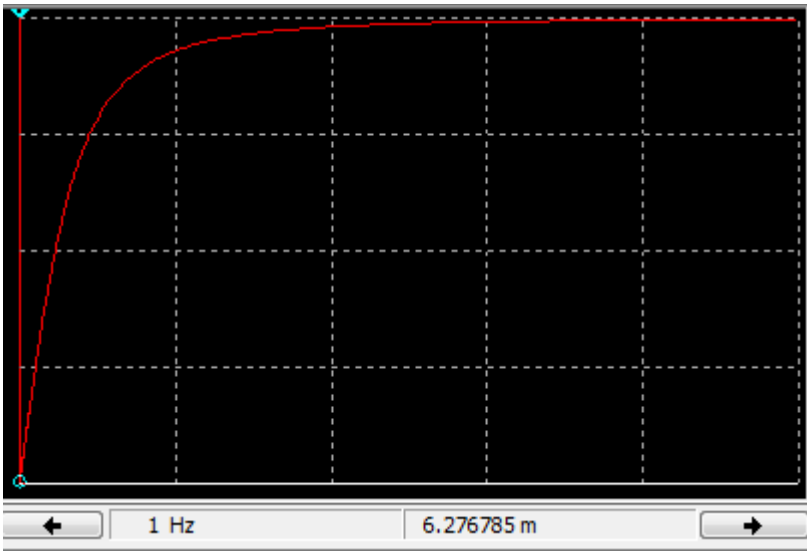
Model



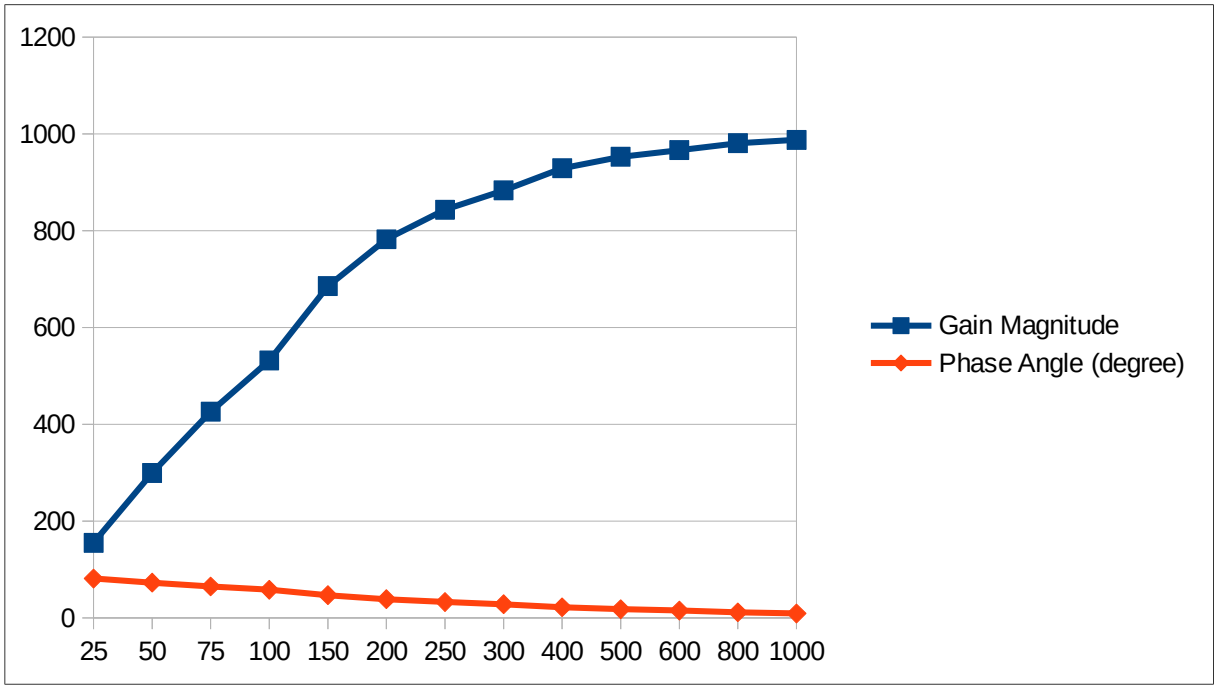
Circuit



Bode



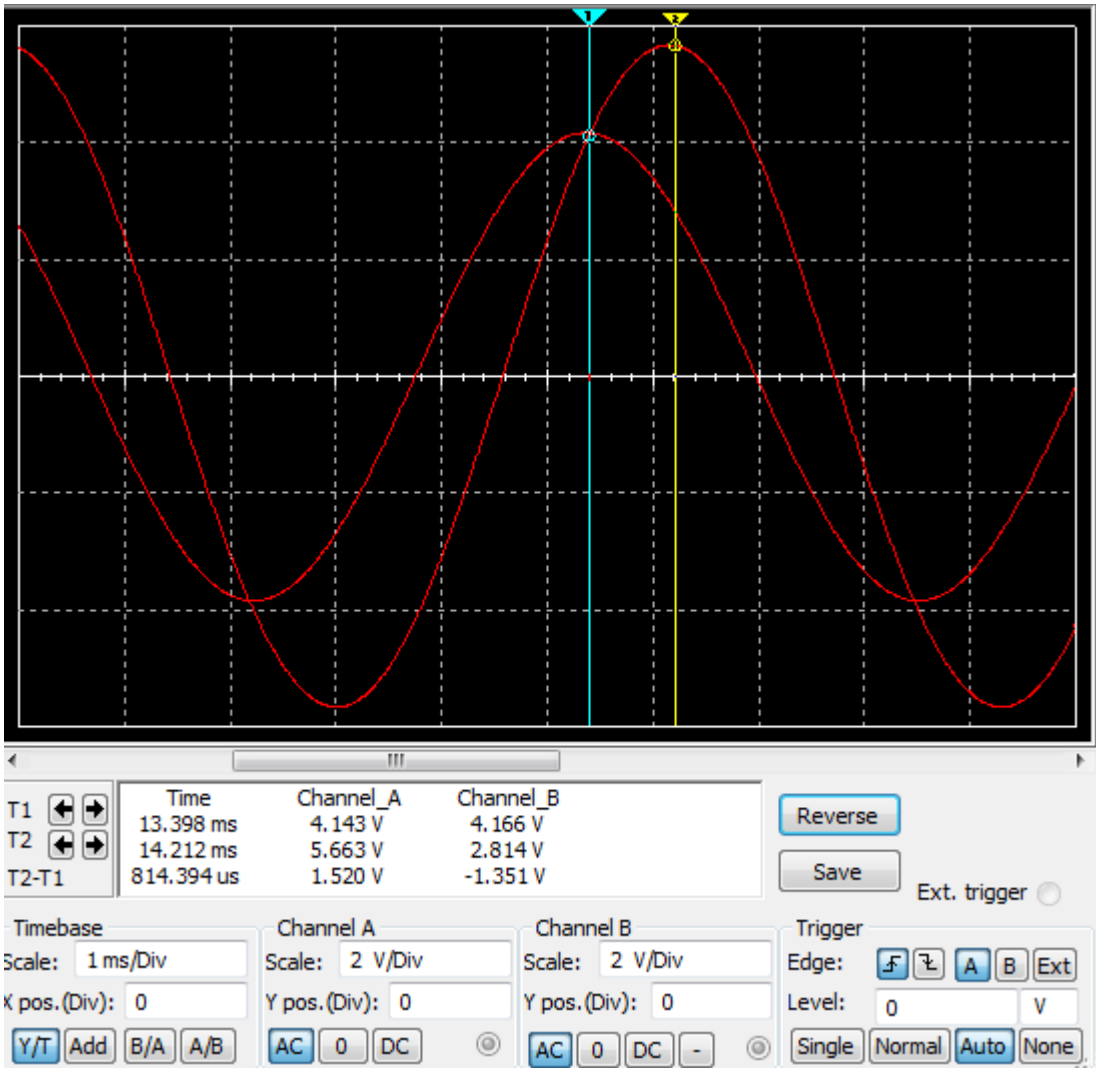
Results



Data

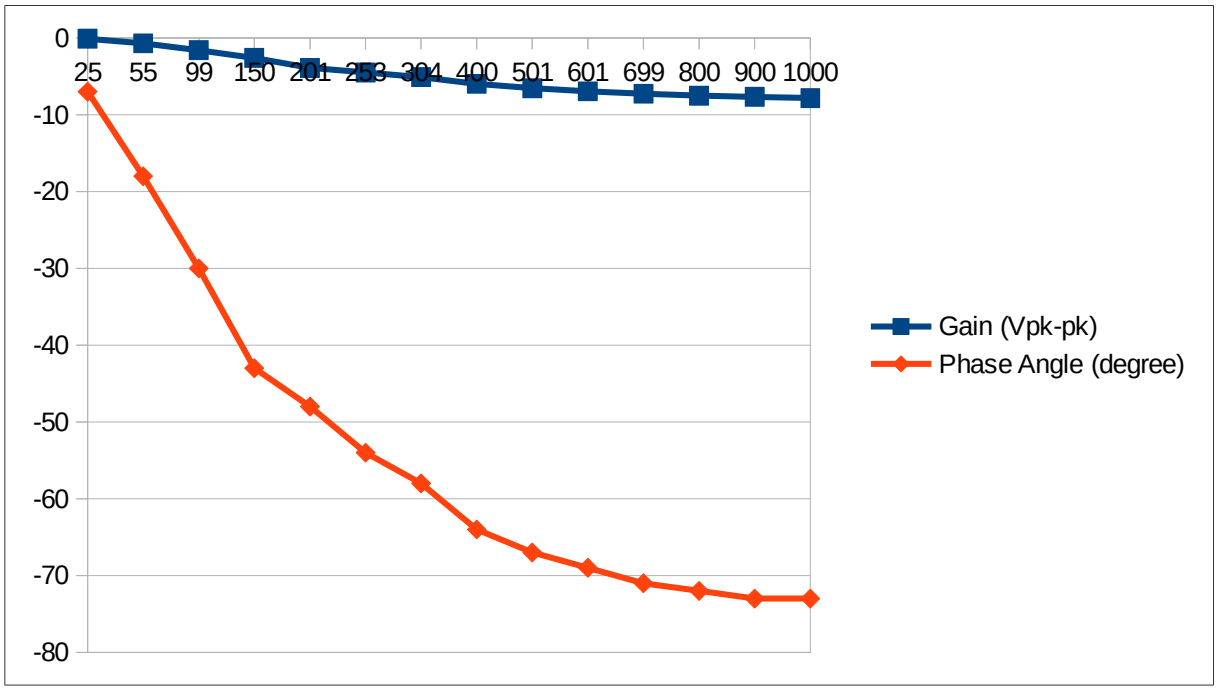
Frequency (Hz)	Gain Magnitude	Phase Angle (degree)
25	155.025	81.082
50	299.442	72.576
75	425.918	64.791
100	531.637	57.884
150	685.471	46.726
200	782.162	38.541
250	843.298	32.541
300	883.165	27.972
400	929.010	21.718
500	952.797	17.674
600	966.502	14.871
800	980.736	11.264
1000	987.546	9.052

Oscilloscope



Hardware – Low Pass

Results



Data

Frequency (Hz)	Gain (V_{pk-pk})	Phase Angle (degree)
25	-0.1	-7
55	-0.7	-18
99	-1.6	-30
150	-2.6	-43
201	-3.9	-48
253	-4.5	-54
304	-5.1	-58
400	-5.98	-64
501	-6.55	-67
601	-6.95	-69
699	-7.27	-71
800	-7.51	-72
900	-7.67	-73
1000	-7.83	-73

Conclusion

In this lab we saw how RC filters could be implemented to modify input signals based on their frequency. In both the simulation and hardware portion of the lab, the placement of the capacitor was an ostensible task which aided in visualizing how the system works. Based on the mathematical structure behind the circuit, provided in the manual, we know that modifying the constants associated with the capacitor and resistor allow us to tune the filter for specific use cases, though the general model has limitations which lead it to be replaced for more demanding tasks.