Lab 8: Sinusoidal Steady-State Response of a 2nd Order Circuit

ECEN 214 - 517

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Due Date: November 18, 2020

Procedure

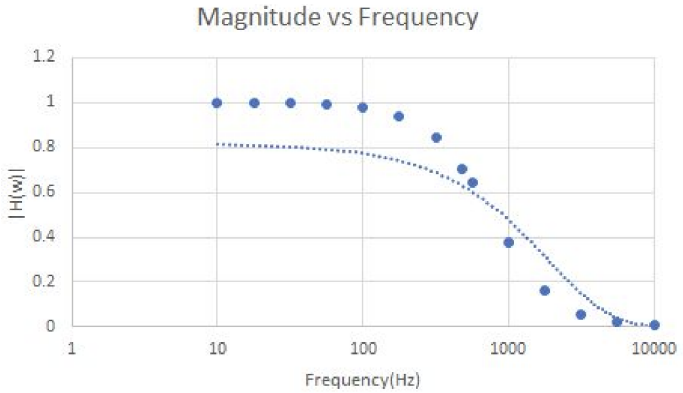
Task 1

For part A, we utilized the pre-labs components and figures to recreate on a circuit board. Using a function generator we were able to execute a sine wave as input voltage and the waves represent both input and output voltages. We repeated this for multiple values: 10Hz, 18Hz, 32Hz, 56Hz, 100Hz, 178Hz, 316Hz, 562Hz, 1,000Hz, 1,778Hz, 3,162Hz, 5,623Hz, 10kHz, and calculated the amplitudes of input and output values, phase difference, etc.

For part B of this experiment, we continued to adjust the input sine wave until the ratio reached 0.707, once we found that, we calculated the amplitude of the input and output voltage and phase difference.

Data Tables

Task 1: Part A&B

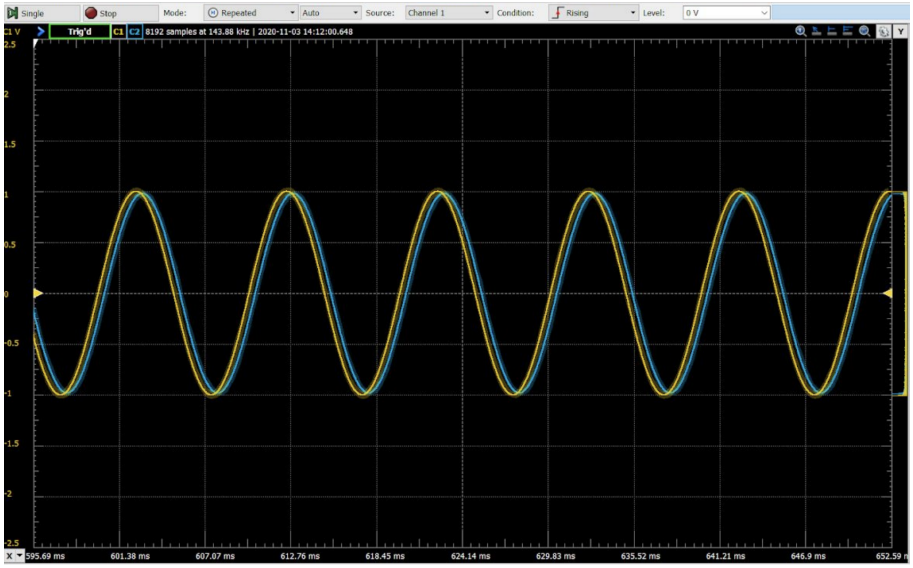


Frequency (Hz)	V_{in} (V)	V_{out} (V)	Time (micro Seconds)
10	1.0016	1.0011	0
18	1.0013	1.0004	543.8
32	1.0011	.99879	477.3
56	1.001	.995101	518.7
100	1.0016	.9805	452.4
178	1.0012	.94179	420.8
316	1.001	.84325	382.4
483	1.0012	.7071	384.8
562	1.005	.644	346.1

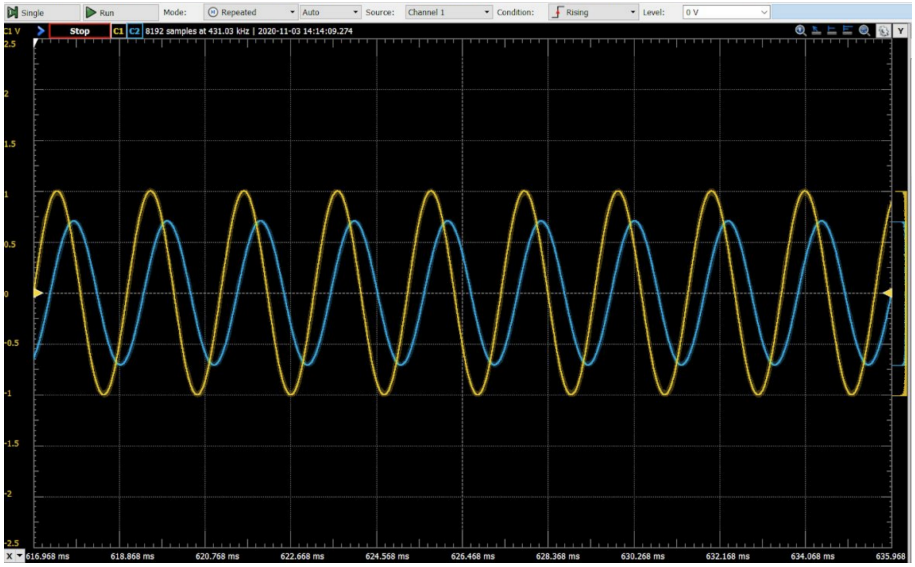
1000	1.0005	.3742	279.3
1778	1.0016	.16211	201.7
3162	1.0018	.05874	132.7
5632	1.003	.01941	78.3
10000	1.0033	.00841	16.3

Waveforms

10Hz



483Hz



Discussion

For the low-pass filter, the stop-band is nearly 700 Hz and the pass-band is 100 Hz. For the high-pass filter, the stop-band is around 100 Hz and the pass-band is 10 kHz. To change the range of the stop and pass bands, the input voltage would change since it is dependent on a few components such as R1, R2, C1, and C2. These components and H(ω) have an inverse relationship, where if you increase the values in the components then the H(ω) will decrease, this will give greater bands. This happens for the low-pass filter at lower frequecnies than high-pass filter. The wave acts like a underdamped response when the output voltage is higher than the input voltage. Improvements in this lab could be adding more data points to complete off the beginning of the curve showing different frequencies.