

Laboratory Four — OP Amps

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Pre-Lab

Lab Data

Voltage Follower

V_{in}	V_{CC}	V_{out}
4.997V	8.00V	3.369V

Table 1: Voltage follower data

Inverting Amplifier

$$R_X = 58475\Omega$$

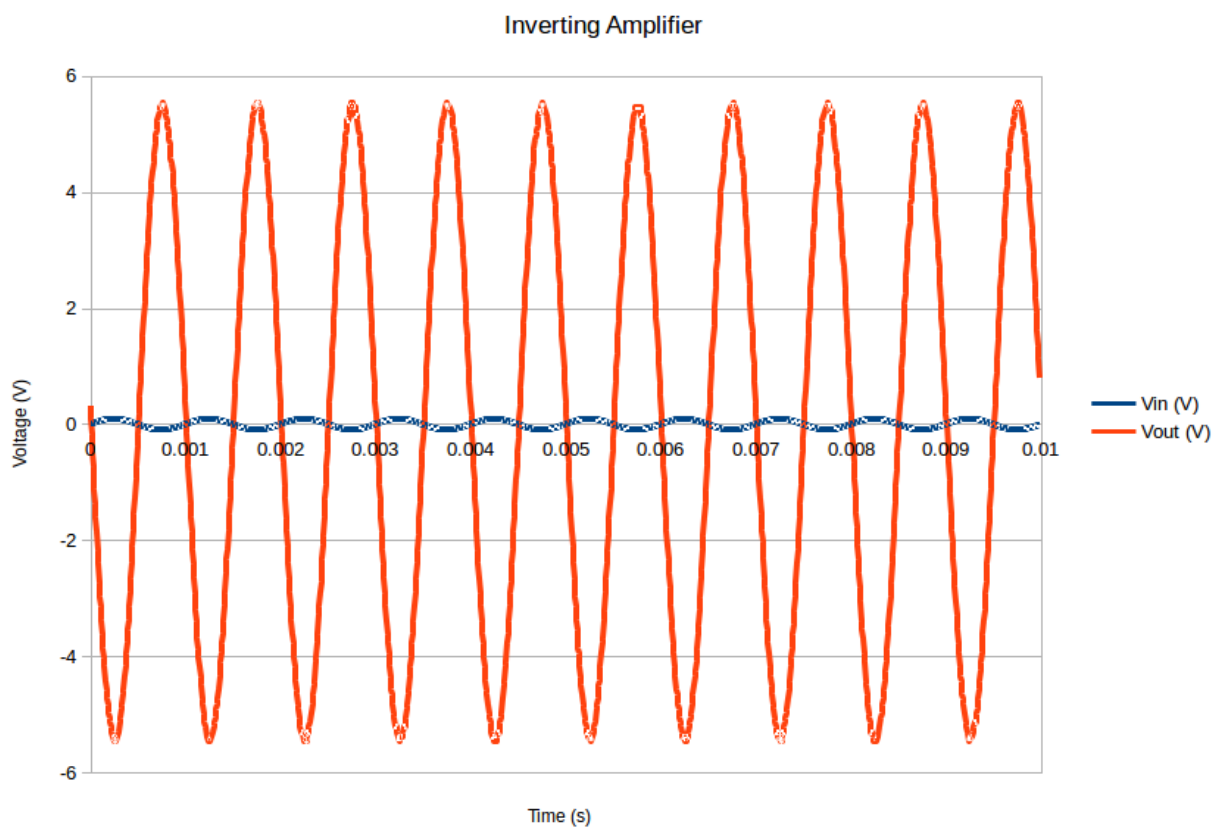


Figure 1: V_{in} and V_{out} vs Time for the inverting amplifier

Non-Inverting Amplifier

$$R_X = 105820\Omega$$

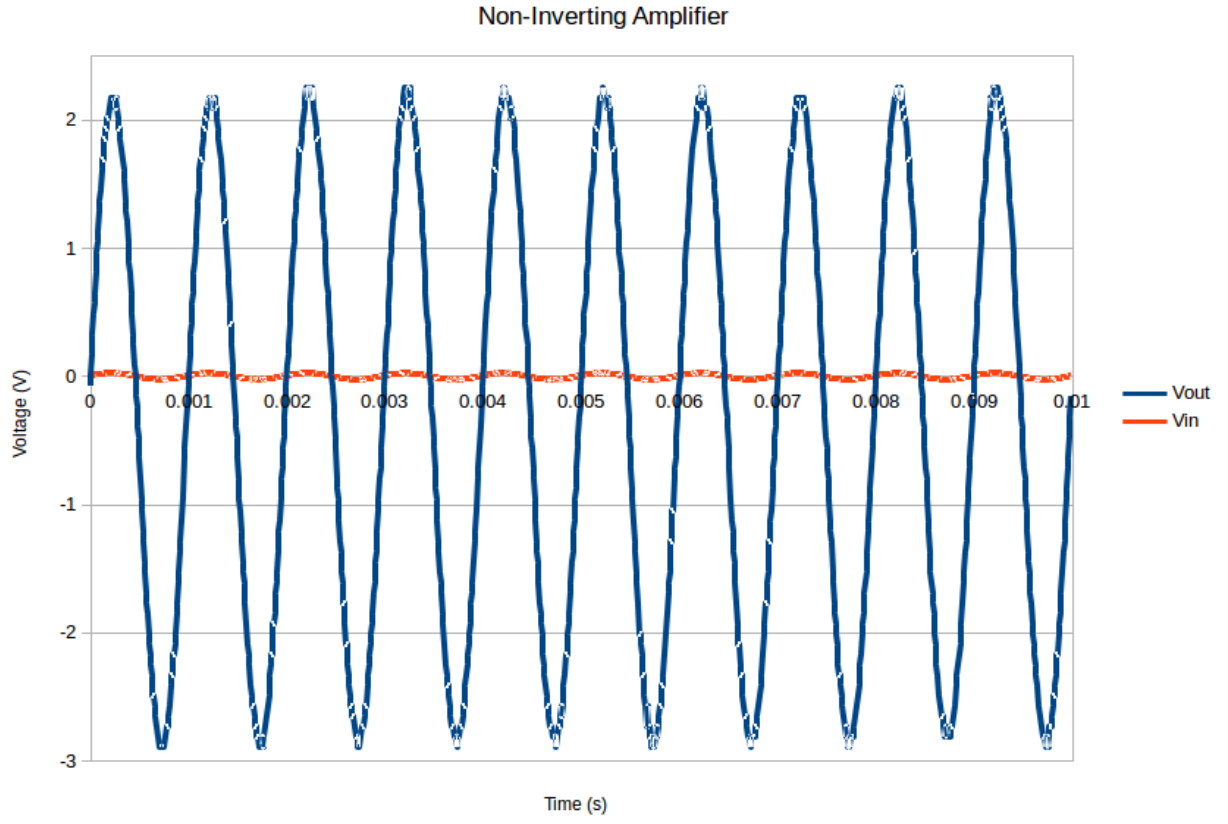


Figure 2: V_{in} and V_{out} vs Time for the non-inverting amplifier

Clipping

$+V_{CC}(V)$	$-V_{CC}(V)$	$V_{OUT,MAX}(V)$	$V_{OUT,MIN}(V)$	$\Delta V + (V)$	$\Delta V - (V)$
15	-15	13.1	-13.3	1.9	-1.7
20	-20	17.7	-17.9	2.3	-2.1

Table 2: Data when $R_L = 2k\Omega$

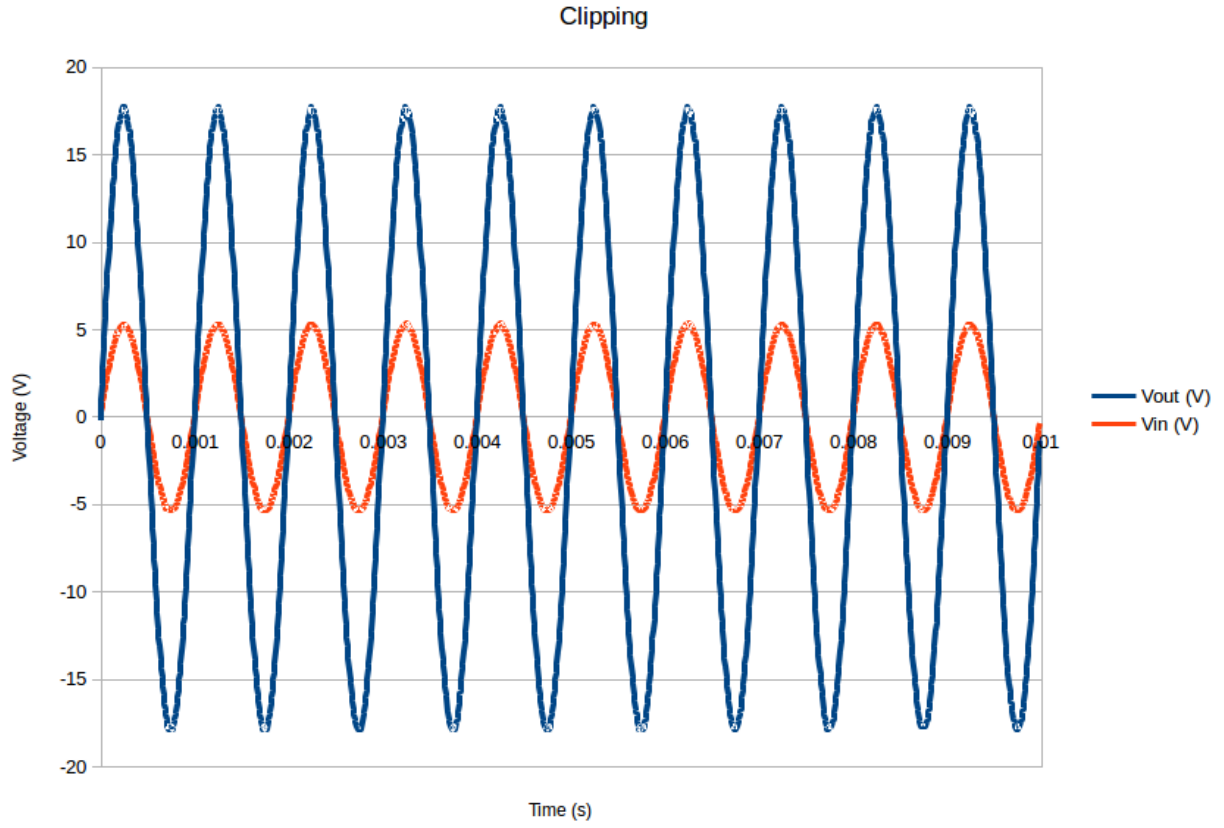


Figure 3: V_{in} and V_{out} vs Time for when $R_L = 2k\Omega$

$+V_{CC}(V)$	$-V_{CC}(V)$	$V_{OUT,MAX}(V)$	$V_{OUT,MIN}(V)$	$\Delta V + (V)$	$\Delta V - (V)$
15	-15	13.3	-13.7	1.7	-1.3
20	-20	18.1	-18.3	1.9	-1.7

Table 3: Data when $R_L = 10k\Omega$

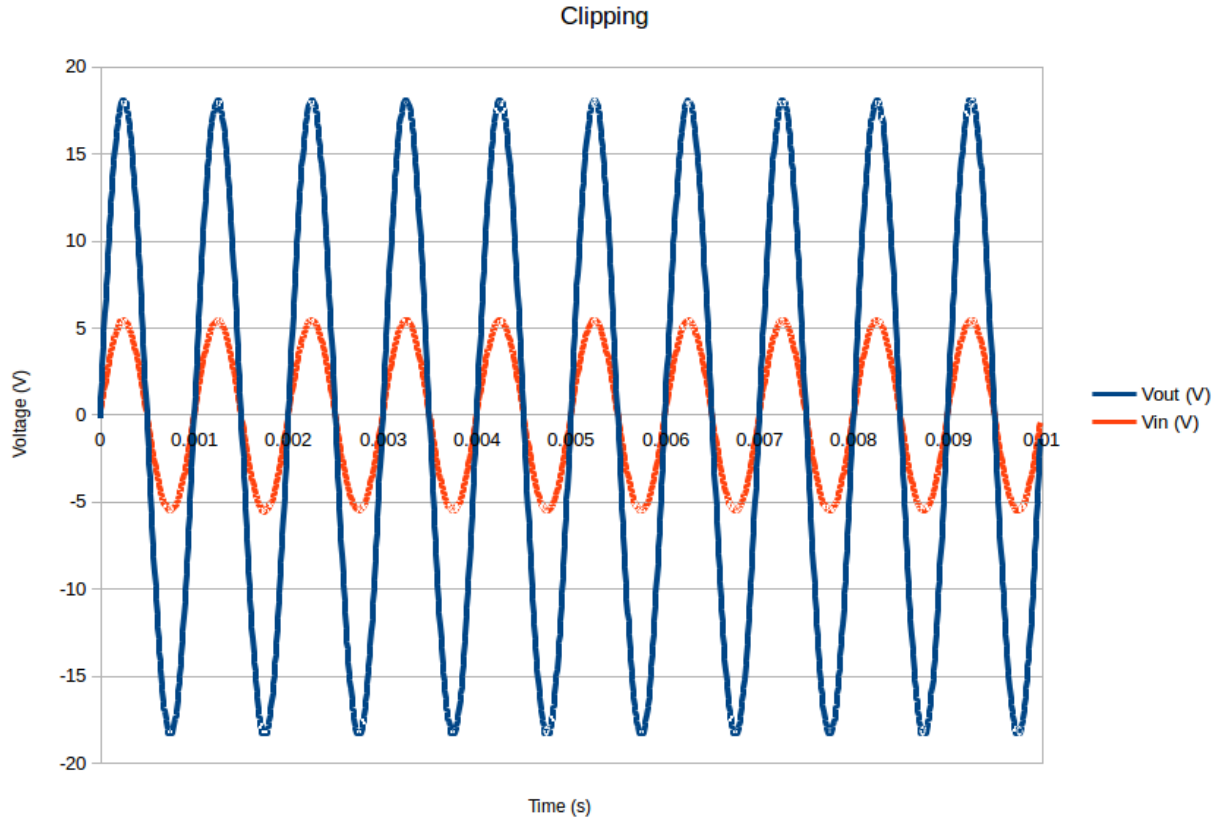


Figure 4: V_{in} and V_{out} vs Time for when $R_L = 10k\Omega$

Phase Shift and Time Delay

Frequency (kHz)	Shift (μs)	Shift ($^\circ$)
2	-13.3	5.38
5	-11.6	-20.5
10	-9.6	-36.3
20	-7.9	-57.2

Table 4: Data for phase shift and time delay

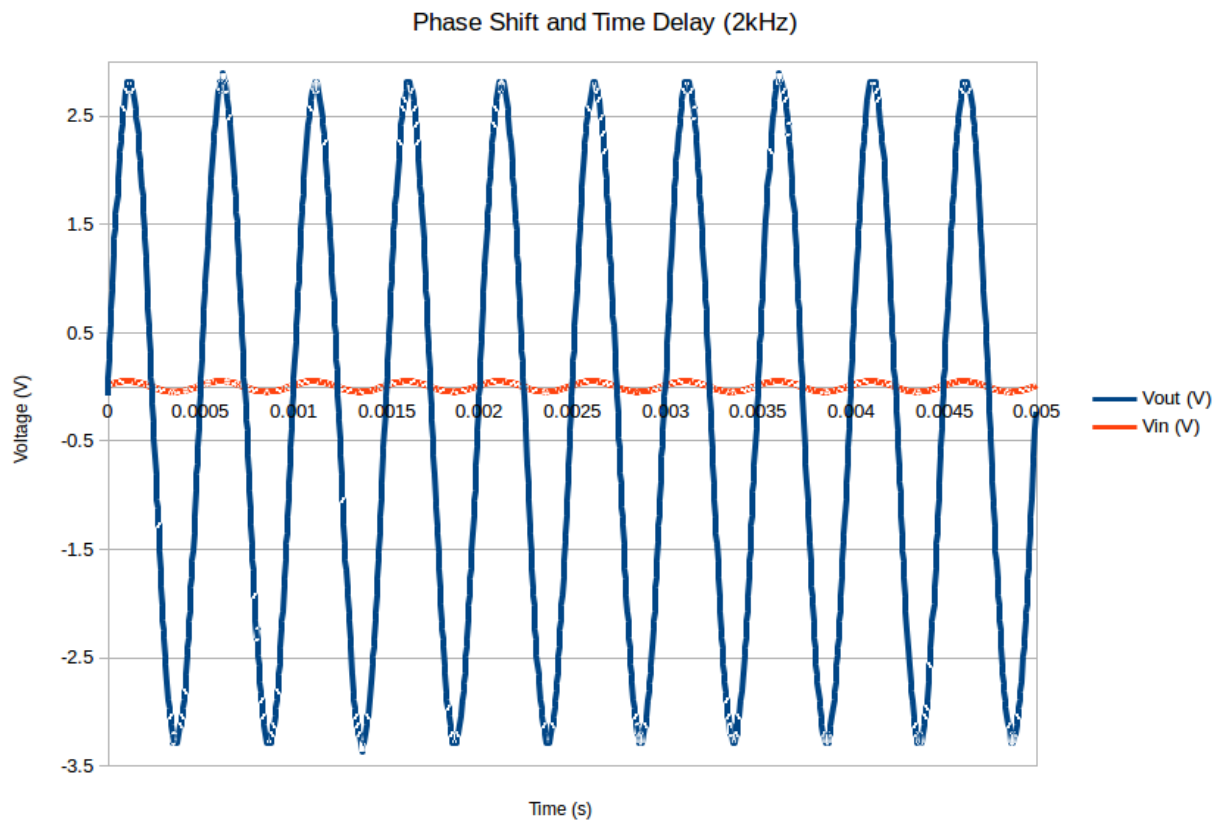


Figure 5: V_{in} and V_{out} vs Time for when frequency is $2kHz$

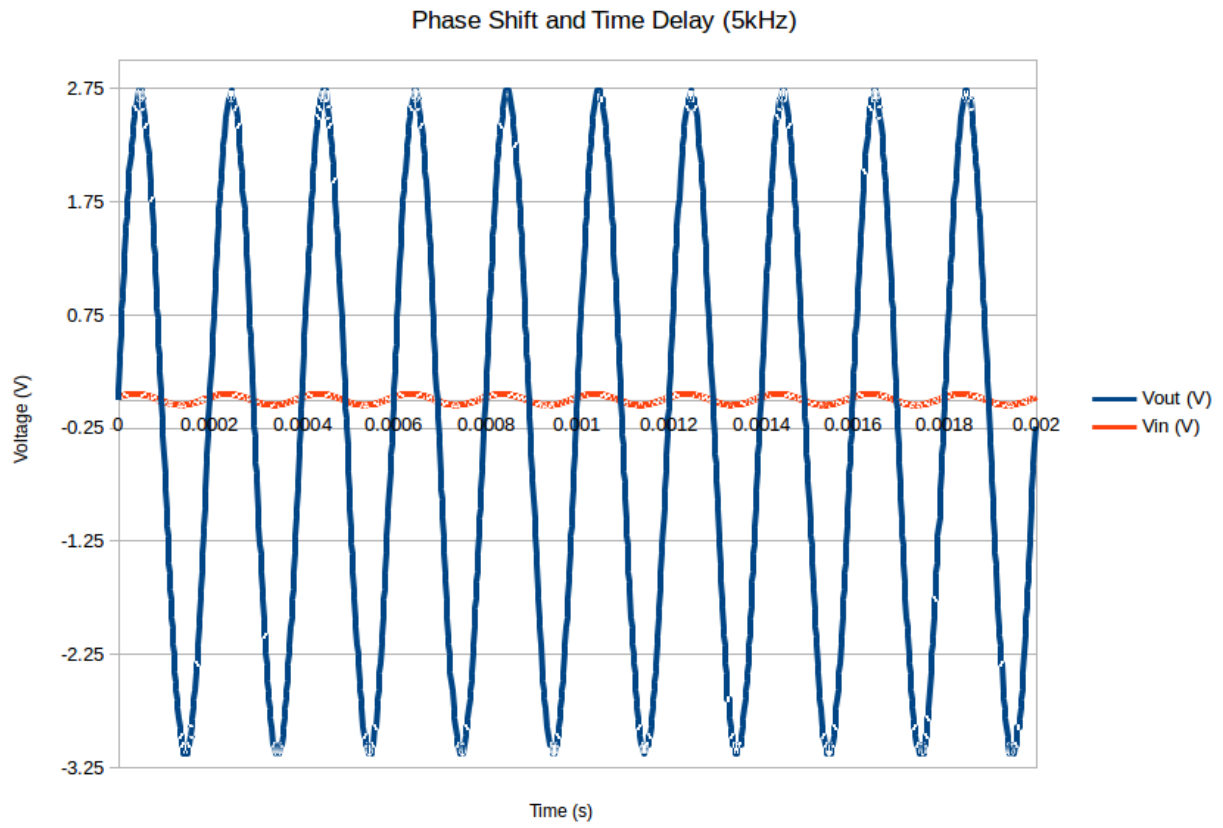


Figure 6: V_{in} and V_{out} vs Time for when frequency is $5kHz$

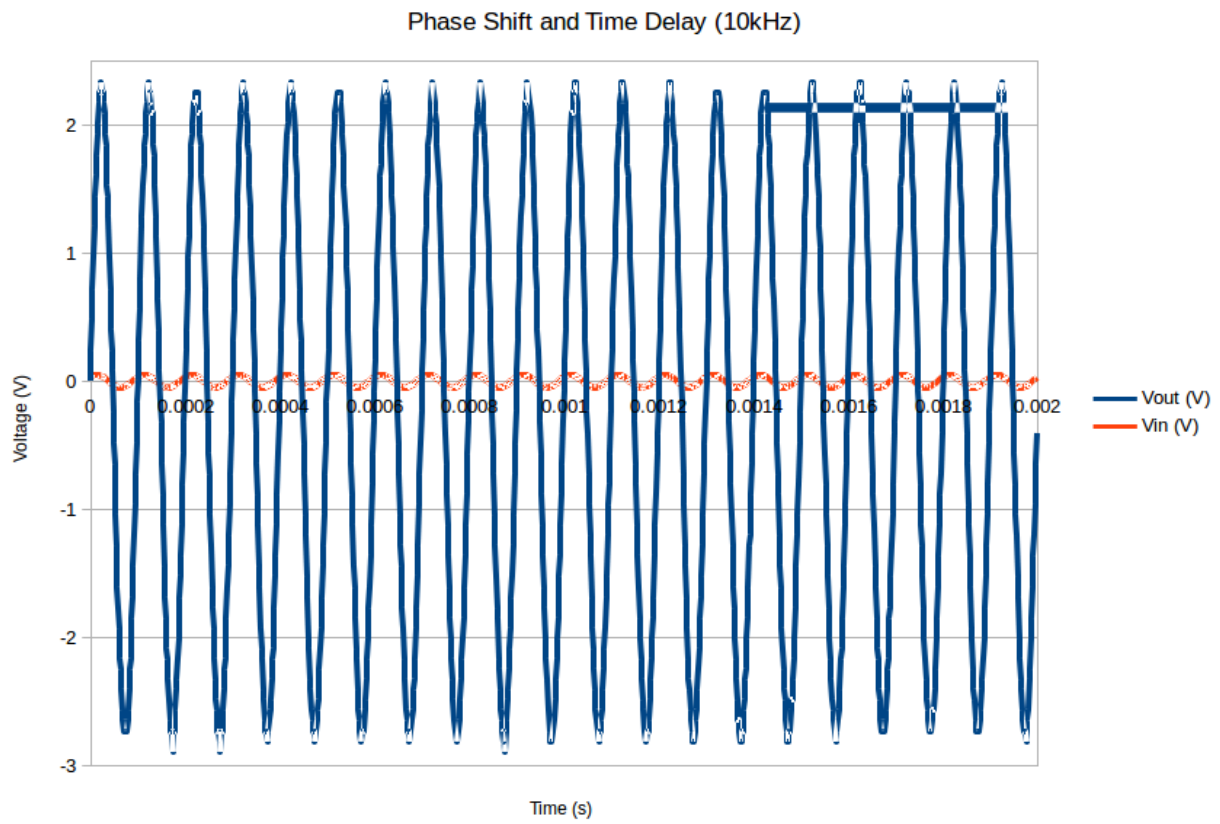


Figure 7: V_{in} and V_{out} vs Time for when frequency is $10kHz$

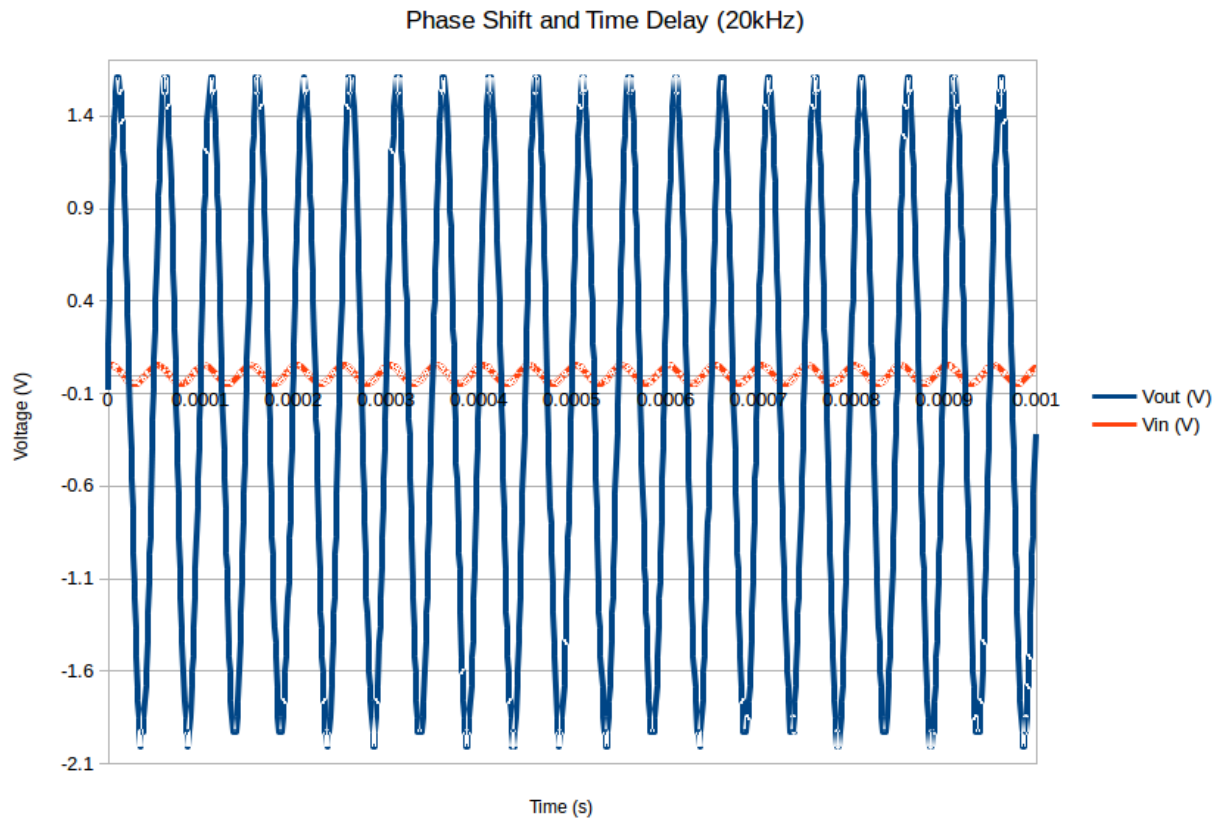


Figure 8: V_{in} and V_{out} vs Time for when frequency is $20kHz$