Digital version

ENGS152 Circuits Lab
RLC seccond order analysis

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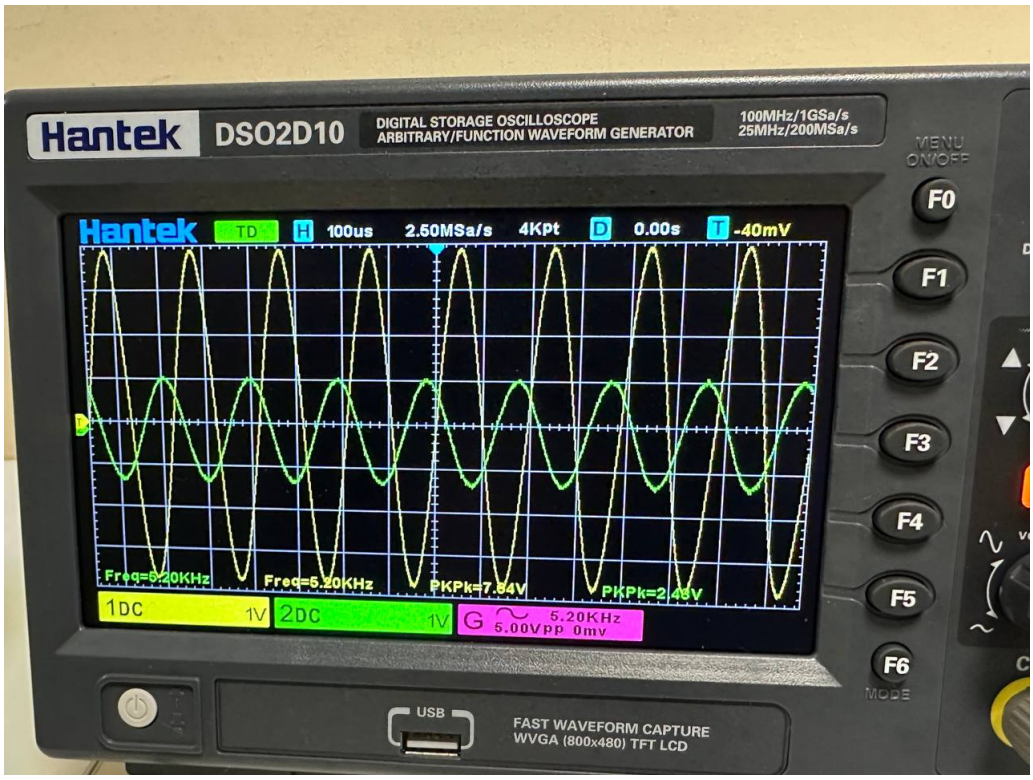
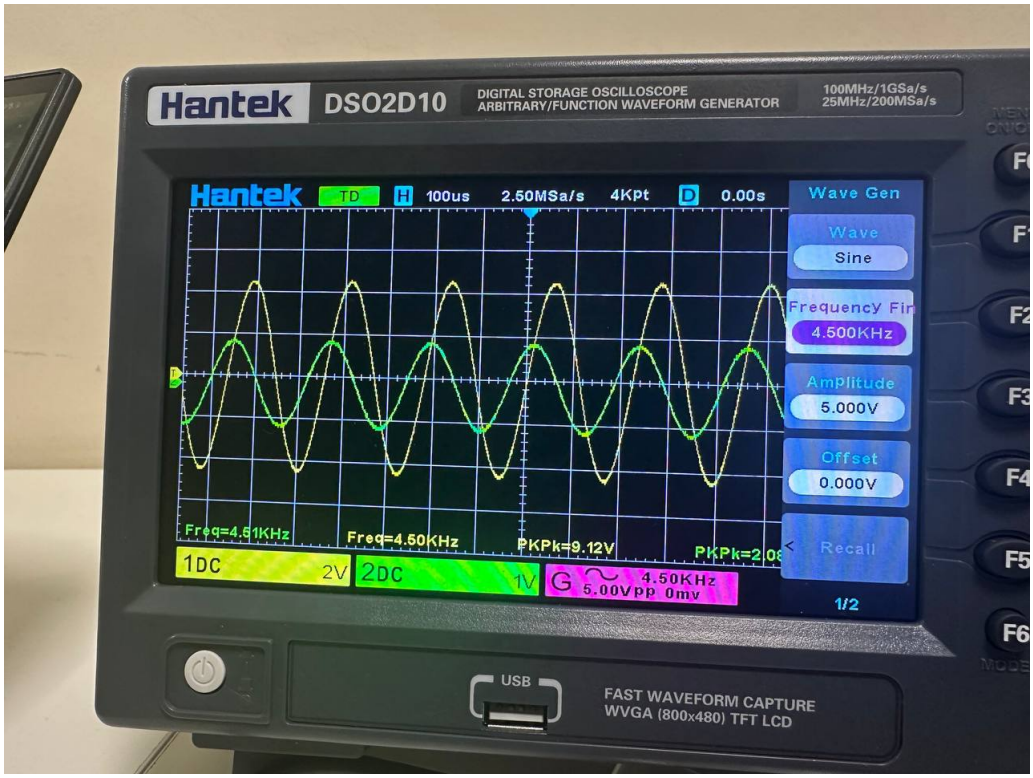
Step 1: LC Oscillator

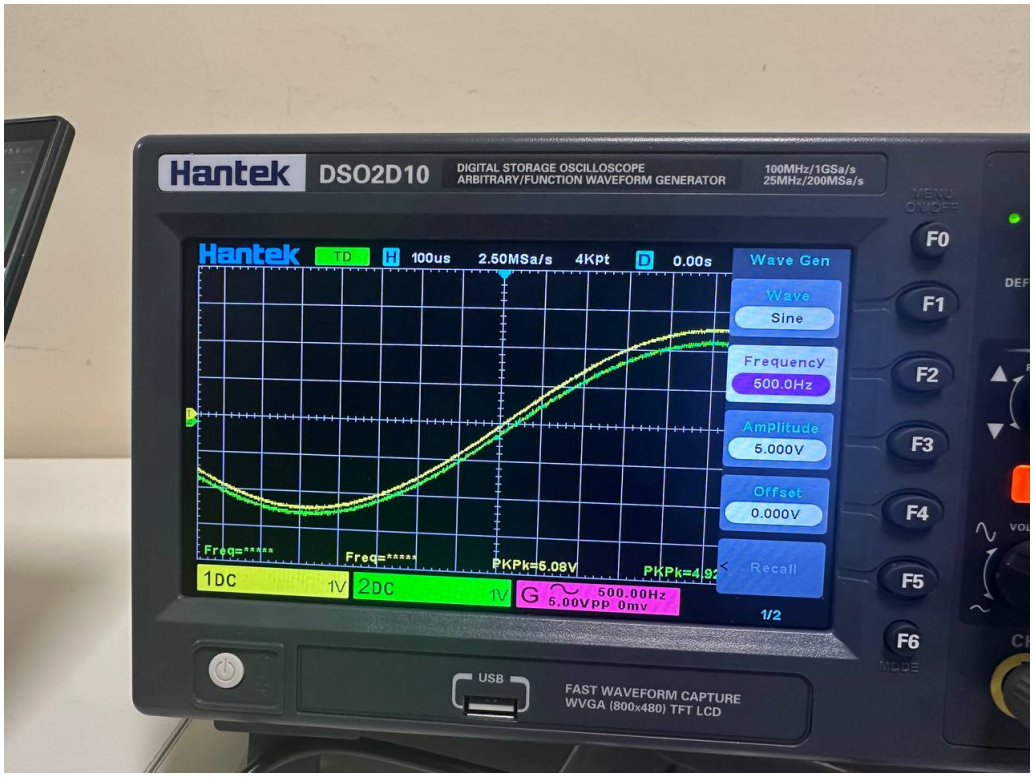
The resonant frequency was calculated $1600Hz$, but since the loading effect on the function generator had an effect of our end result, twice that frequency was chosen: $5200Hz$. $L = 4.7mH$ and $C = 200nF$ was chosen, giving a resonant frequenct of $f \approx 5191Hz$.

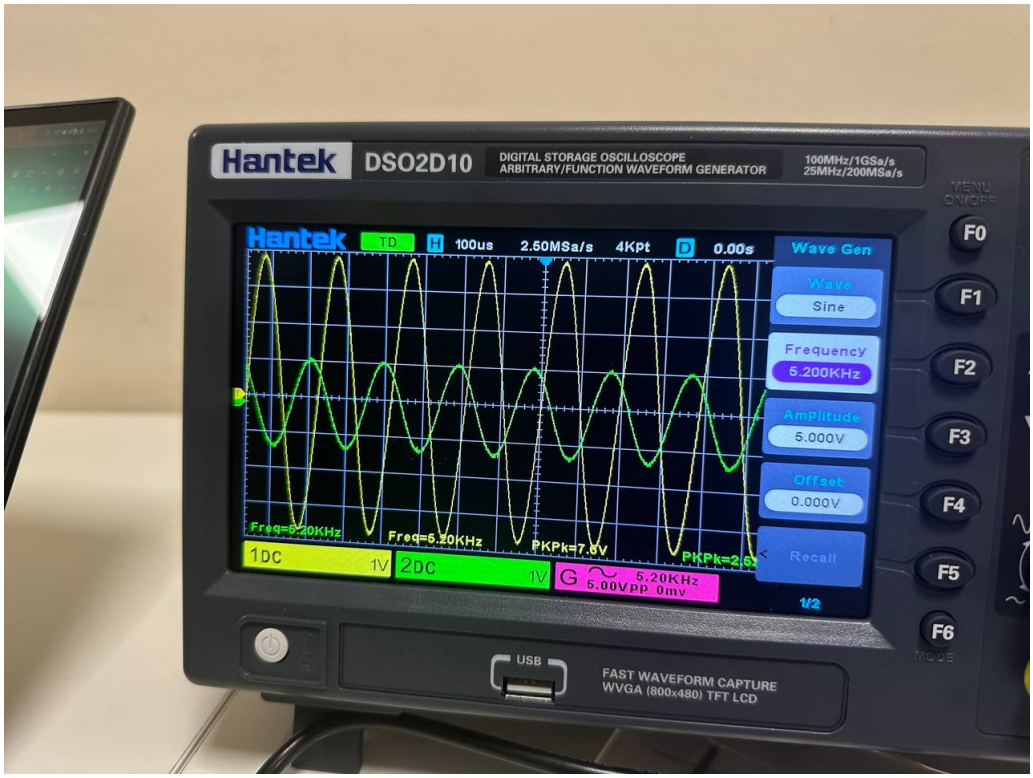


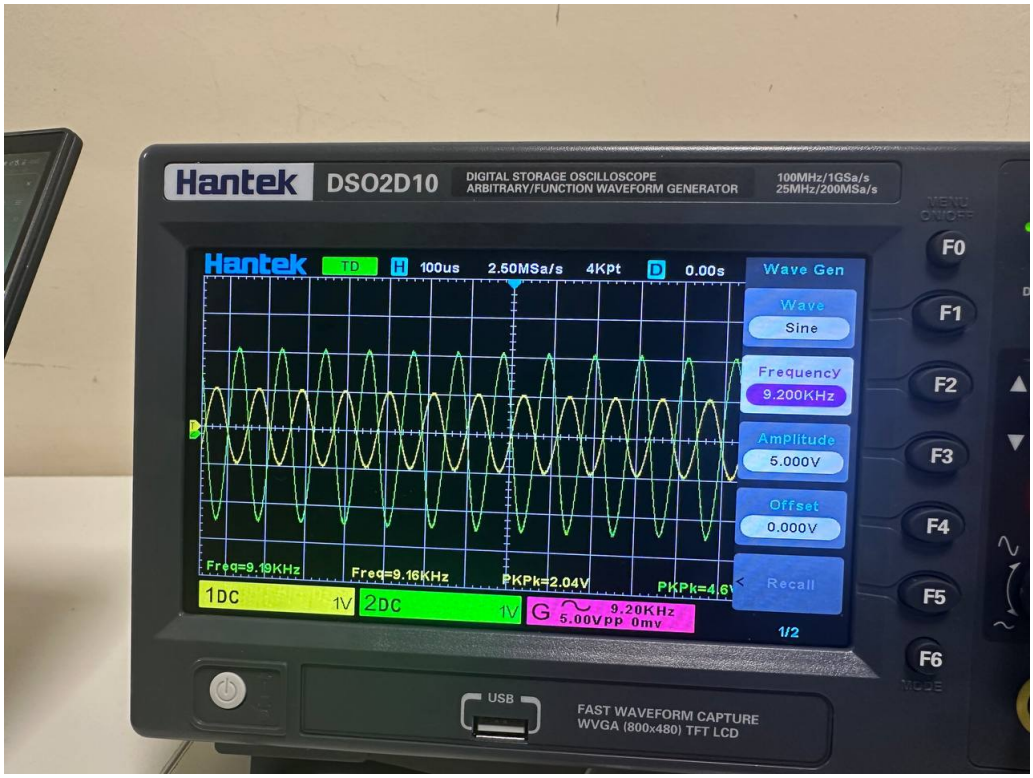
At calculate resontance, peak to peak is $7.84V$, while the input was loaded to $2.48V$, a $3.16x$ amplification.



Because of the loading effect, we weren't able to find the actual resonant frequency, however the maximum voltage accured at $f = 4.50kHz$, which was used for the rest of the lab. The calculated value of $LC \approx 1.25 \cdot 10^9$. If one of the components was correct, the inductor should be $L_1 = 6.25mH$, and the capacitor $C_1 = 266nF$, both with a difference of 33%. This is high, because of the loading effect.



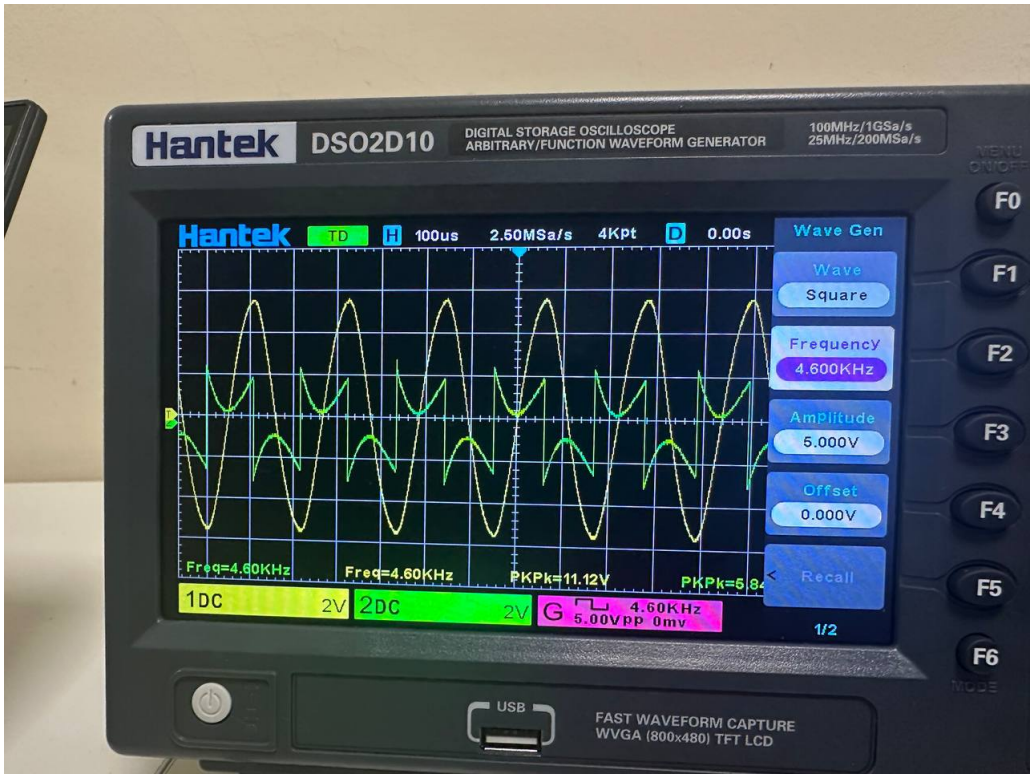


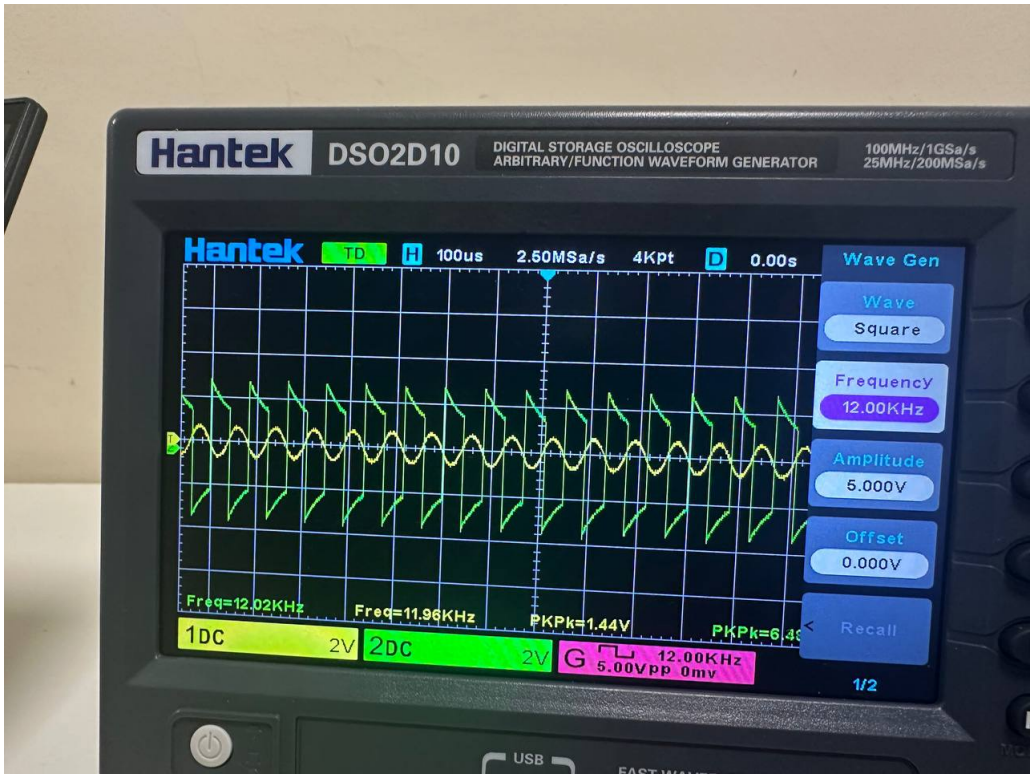


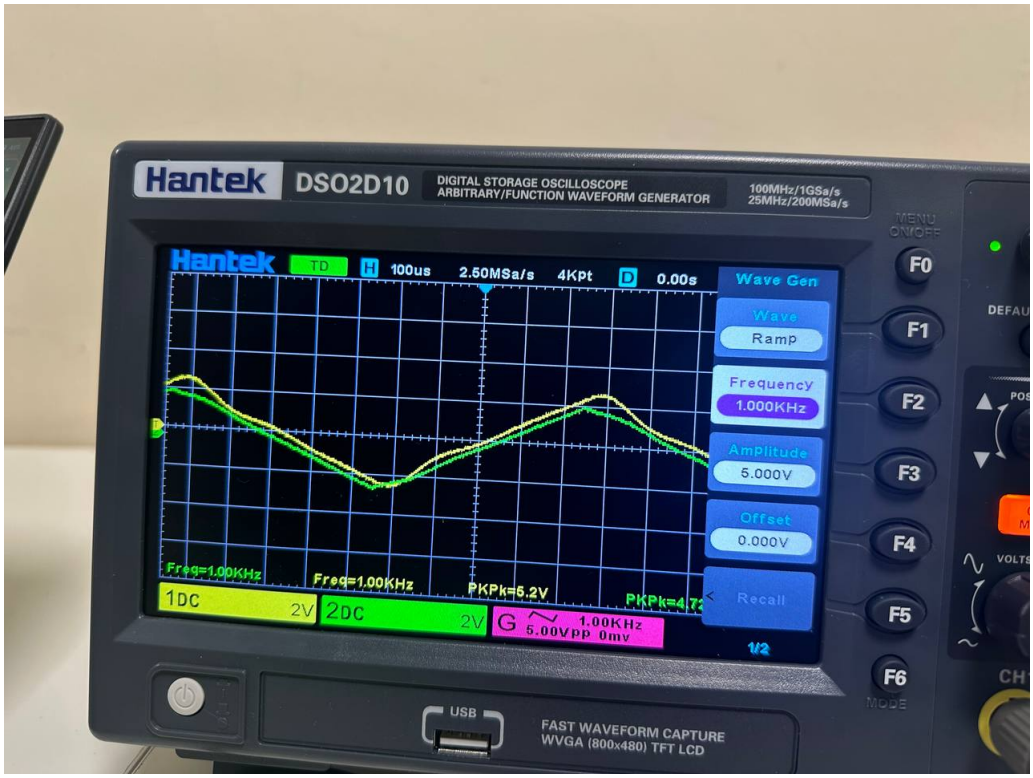
With lower frequencies, the phase shift is low, ideally 0. At resonance it is approximately $\frac{\pi}{2}$ or 90°, while high frequencies it is approximately π or 180°.

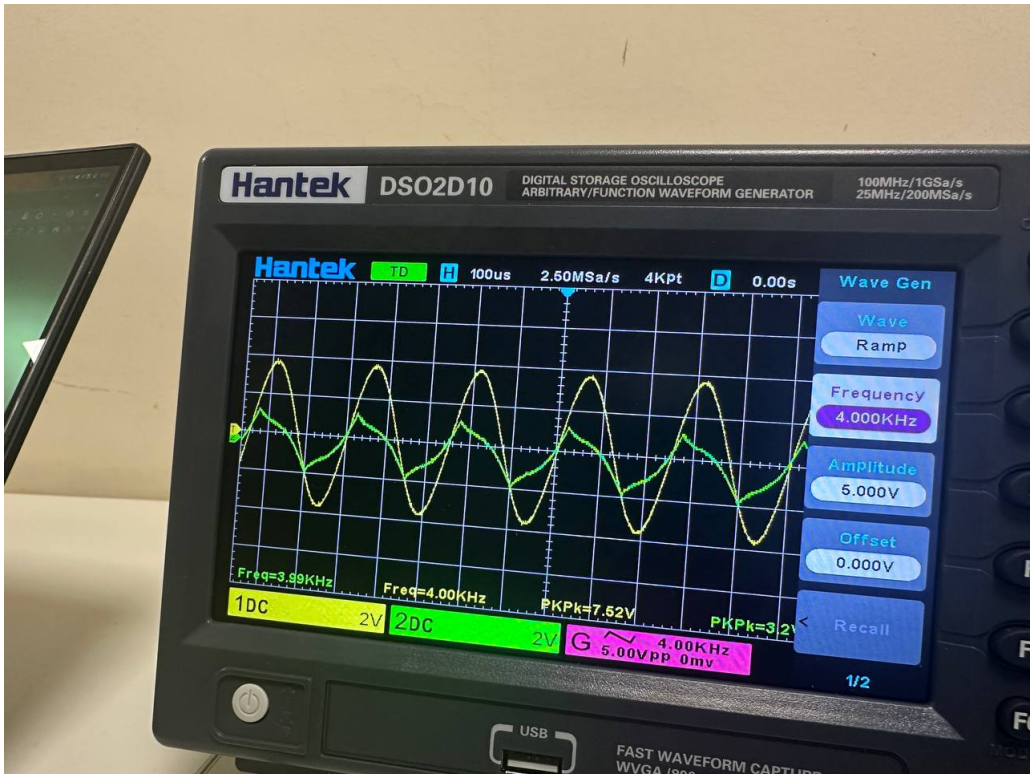
This experiment as repeated with a square wave, triangle wave and an exponential wave.

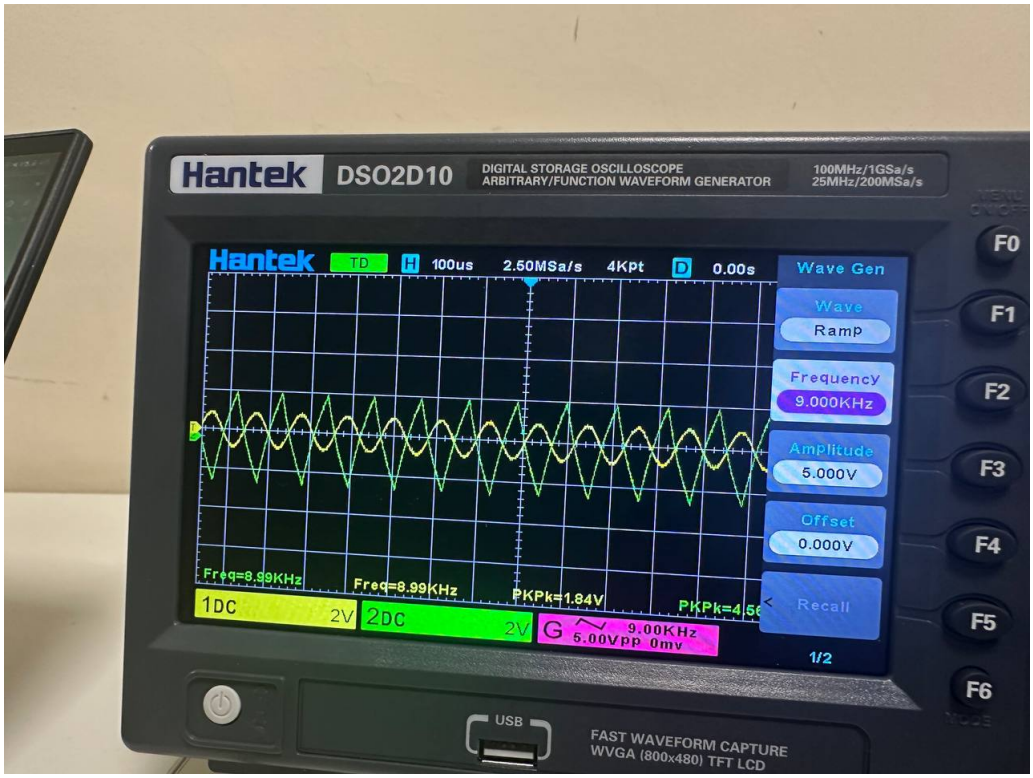

Hantek
DSO2D10
DIGITAL STORAGE OSCILLOSCOPE
ARBITRARY/FUNCTION WAVEFORM GENERATOR
100MHz/1GSa/s
25MHz/200MSa/s
TD
H 100us 2.50MSa/s 4KPt
D 0.00s
Wave Gen
Wave
Square
Frequency
1.800KHz
Amplitude
5.000V
Offset
0.000V
Recall
1/2
Freq=1.80KHz
Freq=1.80KHz
PKPk=8.96V
1DC 2V
2DC 2V
1.80KHz
5.00Vpp 0mv
F0
F1
F2
F3
F4
F5
F6
USB
FAST WAVEFORM CAPTURE
WVGA (800x480) TFT LCD

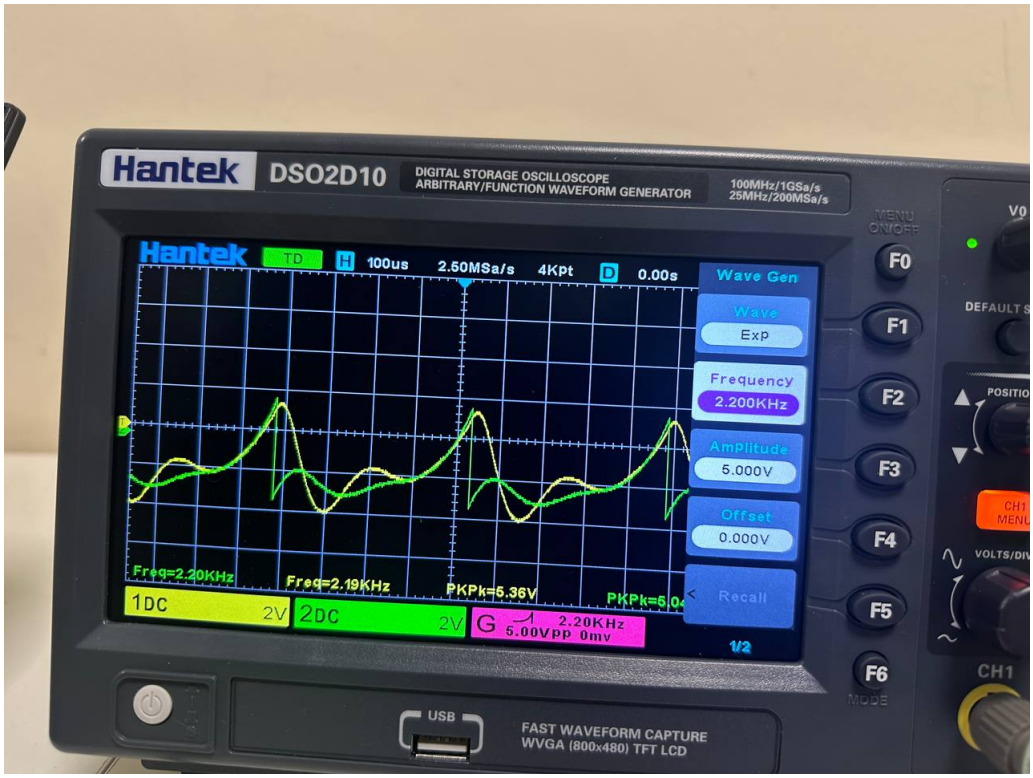

Hantek
DSO2D10
DIGITAL STORAGE OSCILLOSCOPE
ARBITRARY/FUNCTION WAVEFORM GENERATOR
100MHz/1GSa/s
25MHz/200MSa/s
TD
H 100us 2.50MSa/s 4KPt
D 0.00s
Wave Gen
Wave
Square
Frequency
4.600KHz
Amplitude
5.000V
Offset
0.000V
Recall
1/2
Freq=4.60KHz
Freq=4.60KHz
PKPk=11.12V
1DC 2V
2DC 2V
4.60KHz
5.00Vpp 0mv
F0
F1
F2
F3
F4
F5
F6
USB
FAST WAVEFORM CAPTURE
WVGA (800x480) TFT LCD


Hantek DSO2D10
DIGITAL STORAGE OSCILLOSCOPE
ARBITRARY/FUNCTION WAVEFORM GENERATOR
100MHz/1GSa/s
25MHz/200MSa/s
Hantek TD H 100us 2.50MSa/s 4Kpt D 0.00s
Wave Gen
Wave
Square
Frequency
12.00KHz
Amplitude
5.000V
Offset
0.000V
Recall
1/2
Freq=12.02KHz
Freq=11.96KHz
PKPk=1.44V
1DC 2V
2DC 2V
G 12.00KHz
5.00Vpp 0mv
USB


Hantek DSO2D10
DIGITAL STORAGE OSCILLOSCOPE
ARBITRARY/FUNCTION WAVEFORM GENERATOR
100MHz/1GSa/s
25MHz/200MSa/s
Hantek TD H 100us 2.50MSa/s 4Kpt D 0.00s
Wave Gen
Wave
Ramp
Frequency
1.000KHz
Amplitude
5.000V
Offset
0.000V
Recall
1/2
Freq=1.00KHz
Freq=1.00KHz
PKPk=5.2V
1DC 2V
2DC 2V
G 1.00KHz
5.00Vpp 0mv
F0
F1
F2
F3
F4
F5
F6
USB
FAST WAVEFORM CAPTURE
WVGA (800x480) TFT LCD


Hantek DSO2D10
DIGITAL STORAGE OSCILLOSCOPE
ARBITRARY/FUNCTION WAVEFORM GENERATOR
100MHz/1GSa/s
25MHz/200MSa/s
Hantek TD H 100us 2.50MSa/s 4Kpt D 0.00s
Wave Gen
Wave
Ramp
Frequency
4.000KHz
Amplitude
5.000V
Offset
0.000V
Recall
1/2
Freq=3.99KHz
Freq=4.00KHz
PKPk=7.52V
1DC 2V
2DC 2V
G 4.00KHz
5.00Vpp 0mv
USB
FAST WAVEFORM CAPTURE


Hantek DSO2D10
DIGITAL STORAGE OSCILLOSCOPE
ARBITRARY/FUNCTION WAVEFORM GENERATOR
100MHz/1GSa/s
25MHz/200MSa/s
Hantek TD H 100us 2.50MSa/s 4Kpt D 0.00s
Wave Gen
Wave
Ramp
Frequency
9.000KHz
Amplitude
5.000V
Offset
0.000V
Recall
1/2
Freq=8.99KHz
Freq=8.99KHz
PKPk=1.84V
1DC 2V
2DC 2V
G 9.00KHz
5.00Vpp 0mv
F0
F1
F2
F3
F4
F5
F6
USB
FAST WAVEFORM CAPTURE
WVGA (800x480) TFT LCD


Hantek DSO2D10
DIGITAL STORAGE OSCILLOSCOPE
ARBITRARY/FUNCTION WAVEFORM GENERATOR
100MHz/1GSa/s
25MHz/200MSa/s
TD H 100us 2.50MSa/s 4Kpt D 0.00s
Wave Gen
Wave
Exp
Frequency
2.200KHz
Amplitude
5.000V
Offset
0.000V
Recall
1/2
Freq=2.20KHz
Freq=2.19KHz
PKPk=5.36V
1DC 2V
2DC 2V
G 2.20KHz
5.00Vpp 0mv
F0
F1
F2
F3
F4
F5
F6
MENU ON/OFF
MODE
USB
FAST WAVEFORM CAPTURE
WVGA (800x480) TFT LCD
CH1


Hantek DSO2D10
DIGITAL STORAGE OSCILLOSCOPE
ARBITRARY/FUNCTION WAVEFORM GENERATOR
100MHz/1GSa/s
25MHz/200MSa/s
TD H 100us 2.50MSa/s 4Kpt D 0.00s
Wave Gen
Wave
Exp
Frequency
4.500KHz
Amplitude
5.000V
Offset
0.000V
Recall
1/2
Freq=4.50KHz
Freq=4.49KHz
PKPk=4.48V
1DC 2V
2DC 2V
G 4.50KHz
5.00Vpp 0mv
F0
F1
F2
F3
F4
F5
F6
MENU ON/OFF
MODE
USB
FAST WAVEFORM CAPTURE

The outputs are filtered to a sine wave or a sum of sine waves, regardless of the input.