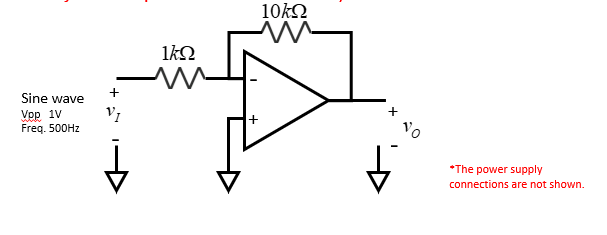
**REPORT**

|  |
| --- |
| **Experiment 1: Non-inverting Amp. vs Inverting Amp.** |

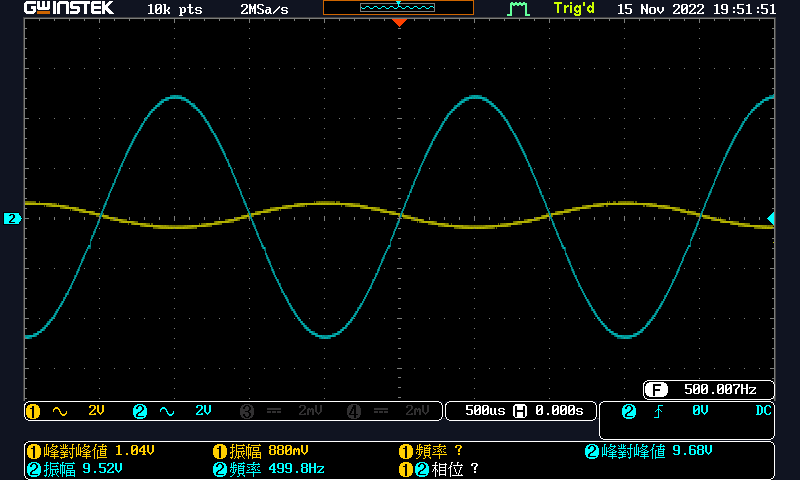


1-1

vin and vout waveform in the same graph with proper scale and measurement, including Vpp and maximum and minimum.

(1pic)

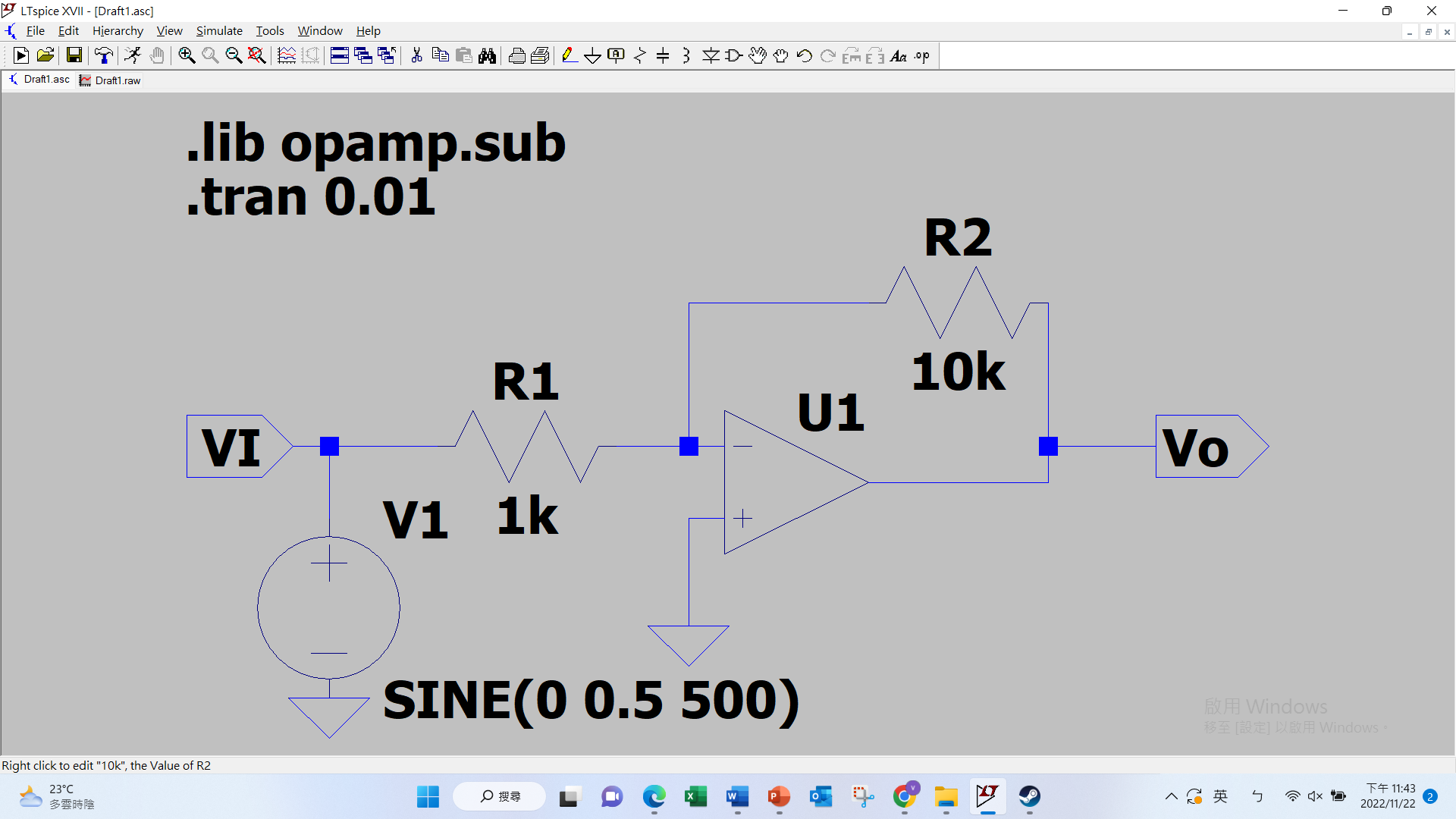
|  |  |  |  |
| --- | --- | --- | --- |
| vin,pp (V) | vout,pp (V) | Measured voltage gain; Av (V/V) | Theoretical voltage gain; Av (V/V) |
| **1.04** | **-9.68** | **-9.3** | **-10** |

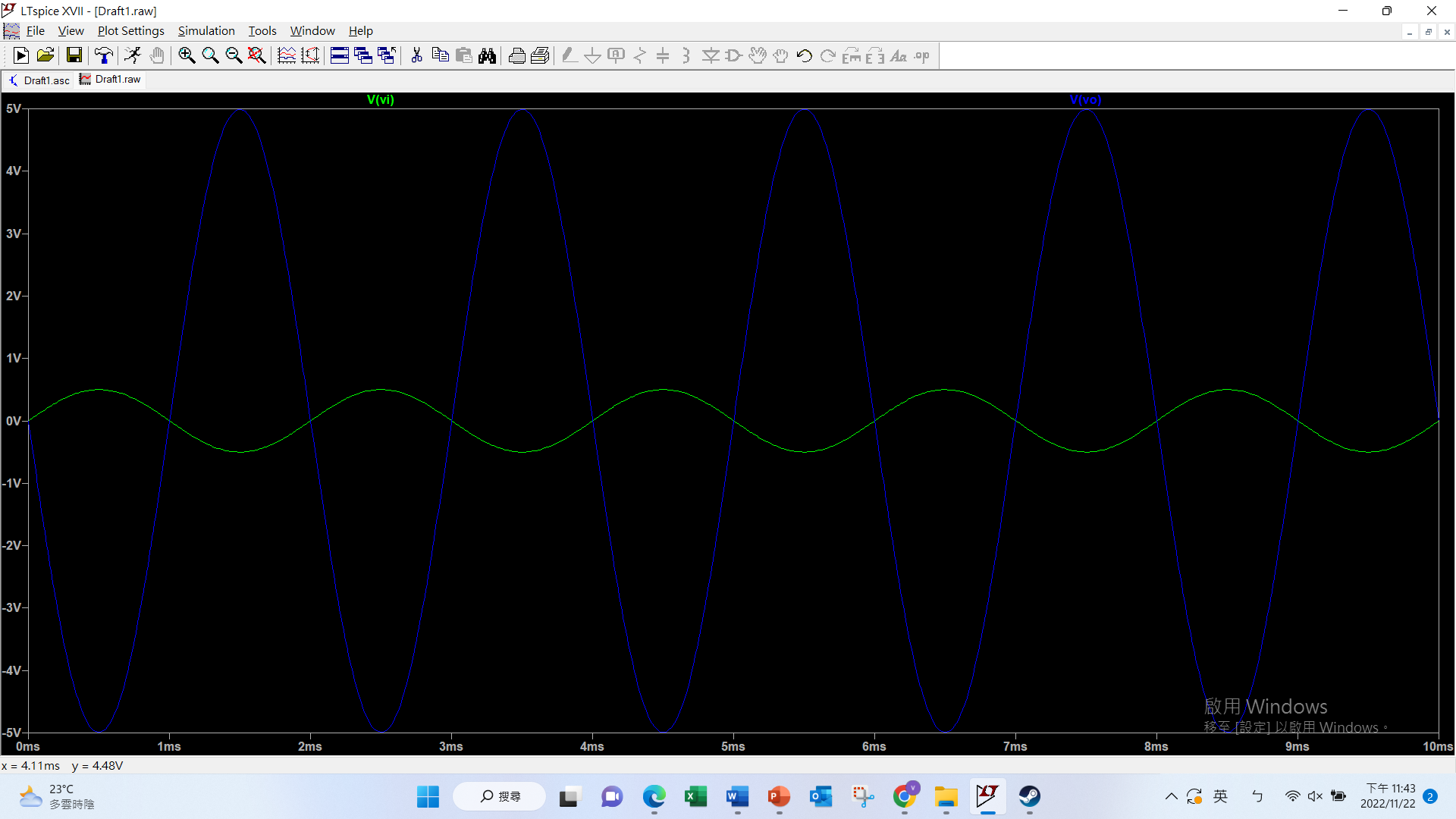


Question:

Please attach your LTSPICE simulation result. (Both schematic and waveform)

(2pic)



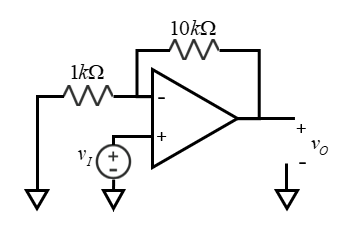


Comparison:

The results of experiment and simulation are similar. Because the temperature, atmospheric pressure and the impedance of amplifier, the output voltage is slightly different.

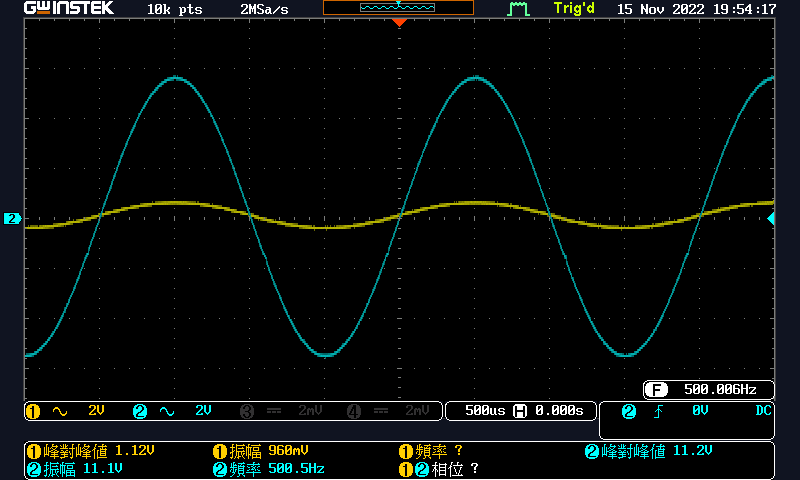
A=Vout,vpp/ Vin,vpp

1-2



vin and vout waveform in the same graph with proper scale and measurement, including Vpp and maximum and minimum.

(1pic)

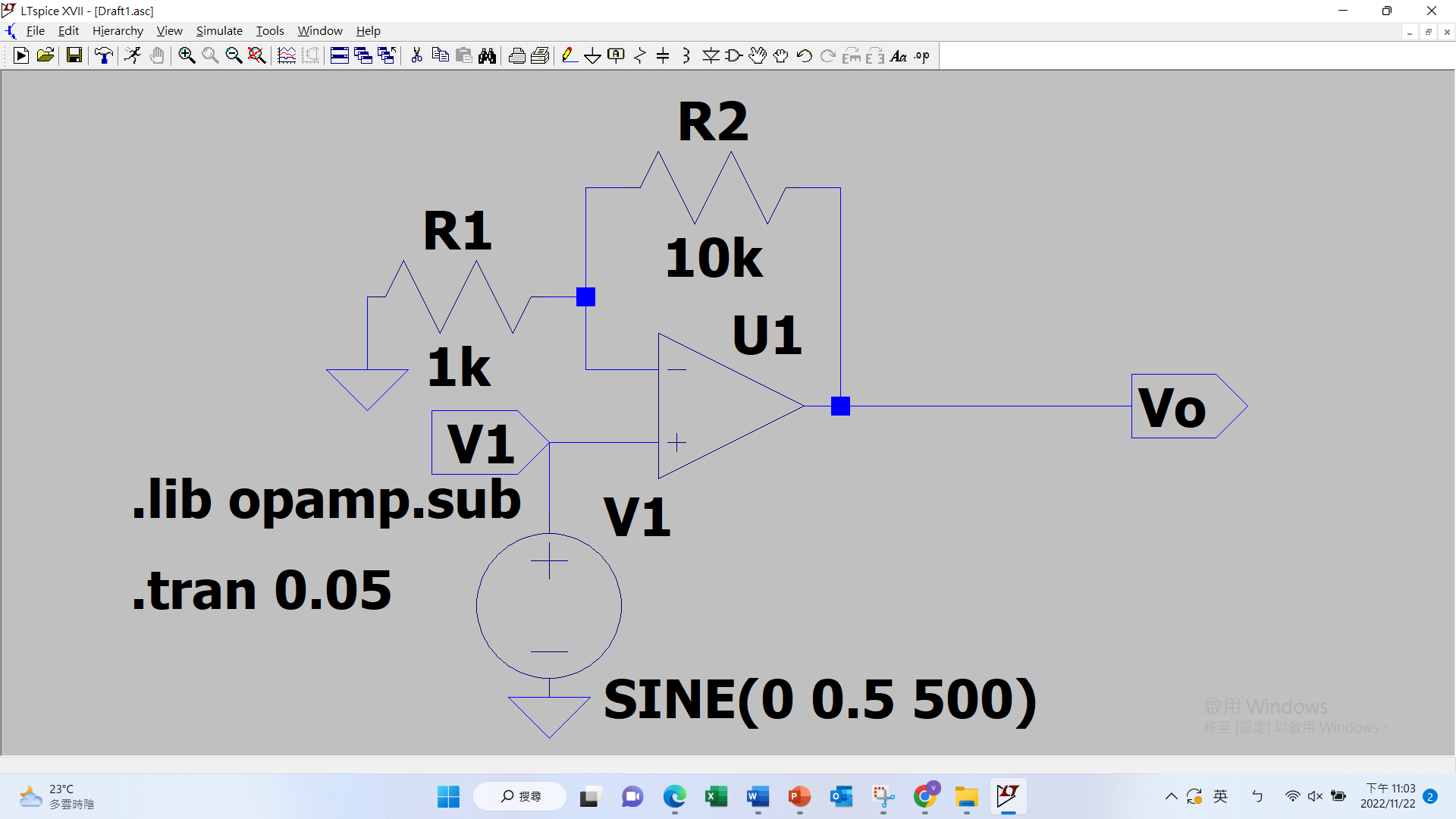


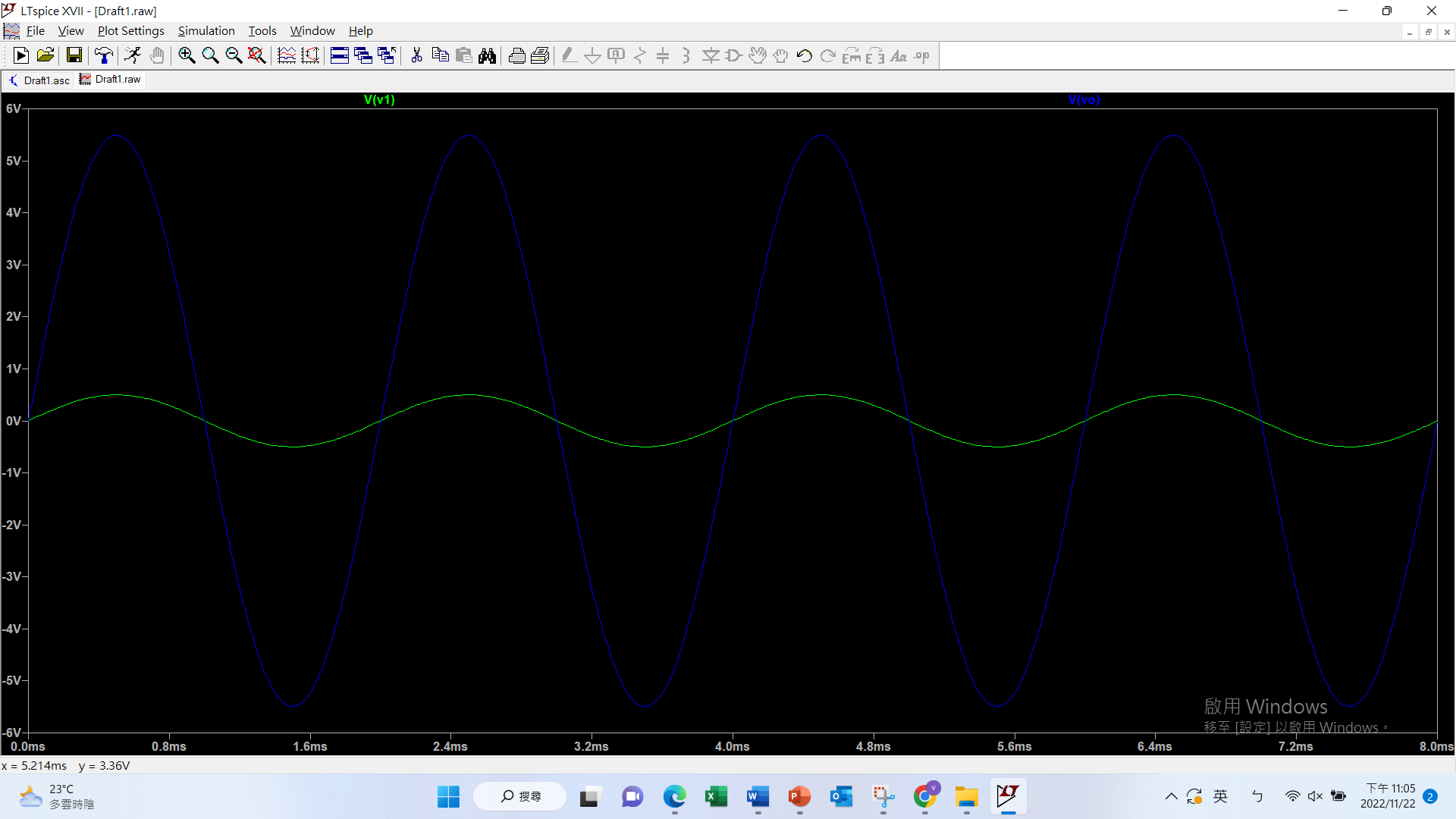
|  |  |  |  |
| --- | --- | --- | --- |
| vin,pp (V) | vout,pp (V) | Measured voltage gain; Av (V/V) | Theoretical voltage gain; Av (V/V) |
| **1.12** | **11.2** | **10** | **10** |

Question:

Please attach your LTSPICE simulation result. (Both schematic and waveform)

(2pic)





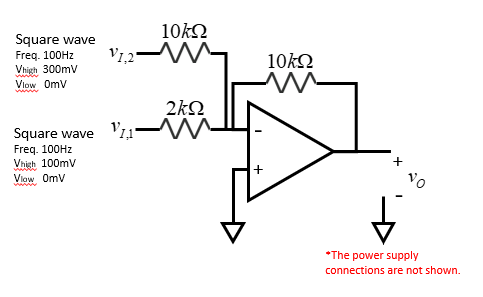
Comparison:

The previous circuit is an inverting amplifier circuit, and this circuit is a non-inverting amplifier circuit. By observing the results, we can see that the output waveform of the previous circuit is inverted compared to the results we see above.

A=Vout,vpp/ Vin,vpp

|  |
| --- |
| **Experiment 2: Weighted Adder** |

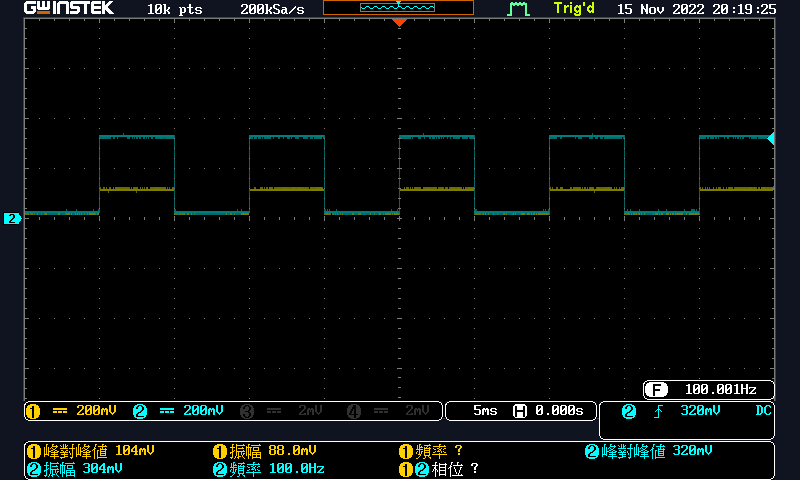
Please use appropiate measurment and show result in proper scale



|  |  |  |  |
| --- | --- | --- | --- |
| vin1,pp (V) | vin2,pp (V) | Measured vout,pp (V) | Theoretical vout,pp (V) |
| **104** | **320** | **860** | **800** |

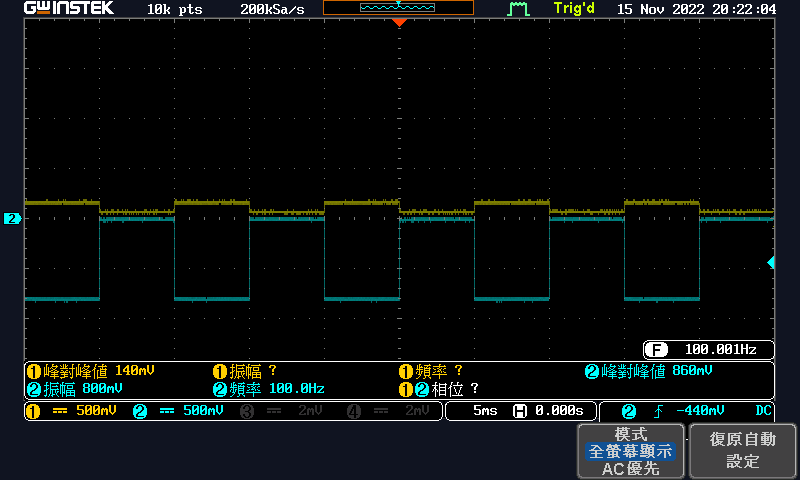
in1 & in2 waveform

(1pic)



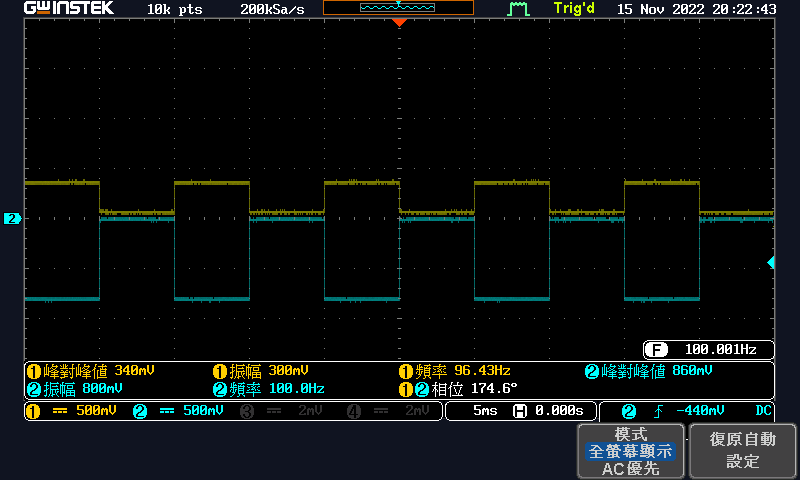
in1 & out waveform

(1pic)



in2 & out waveform

(1pic)



Question:

Please derive the equation for vout. Use symbol (vin1, vin2, R1, R2, R3, etc.) to represent.

Please attach your LTSPICE simulation result. (Both schematic and waveform)

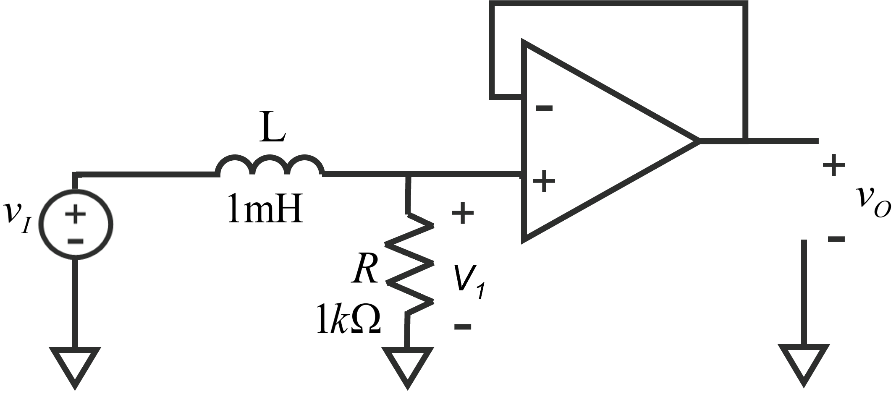
(2pic)

Discuss:

This circuit is similar to the inverting amplifier that we see earlier, but it has two inputs. In question 1, we derived the equation. The equation shows that this circuit adds the input voltages and use the characteristic of inverting amplifier to invert and amplify the signal.

|  |
| --- |
| **Experiment 3: Active filter** |

Please use appropiate measurment and show result in proper scale.



1kΩ

|  |  |
| --- | --- |
|  |  |
|  |  |

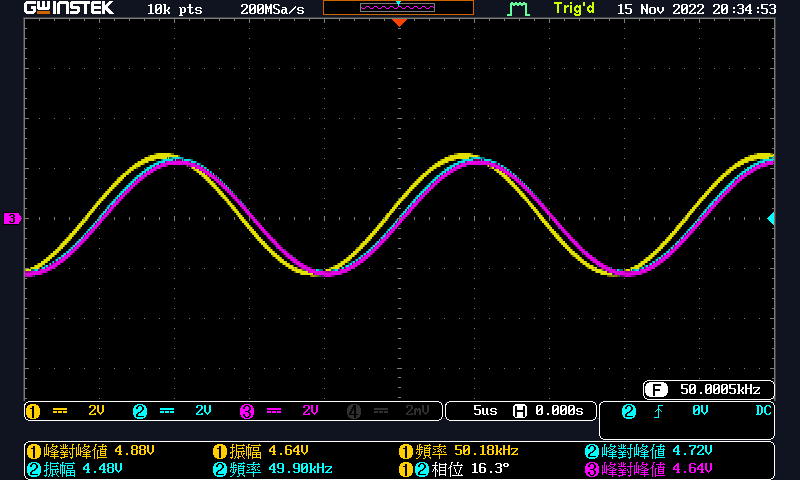
1.

|  |  |  |
| --- | --- | --- |
| Frequency (Hz) | 50kHz | 300kHz |
| V,I,pp(V) | 4.88 | 4.72 |
| Vo,pp(V) | 4.64 | 2 |
| V1,pp(V) | 4.72 | 2.8 |

2.

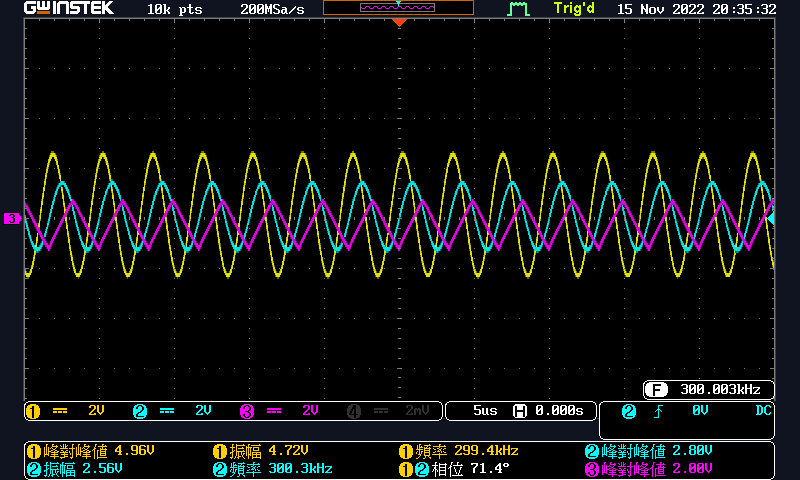
50k Hz Vin , V1, and Vout waveform

(1pic)

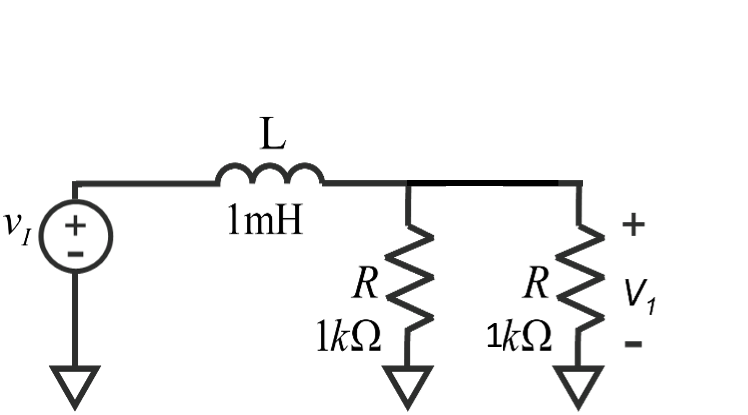


300k Hz Vin , V1, and Vout waveform

(1pic)

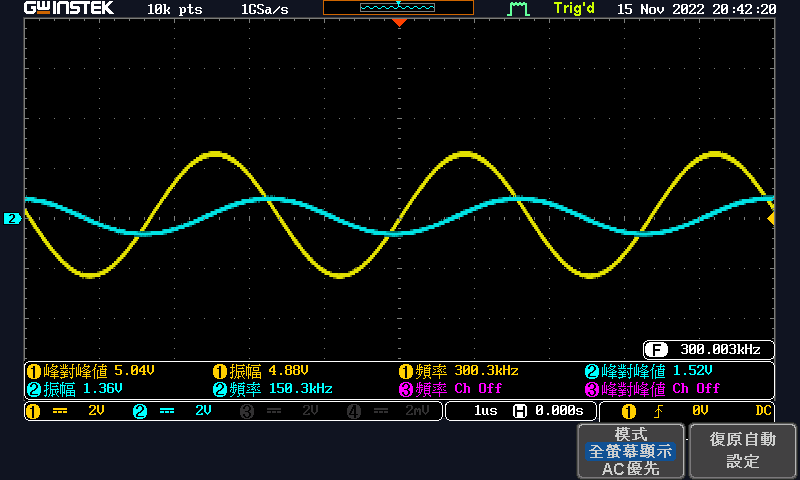


3.

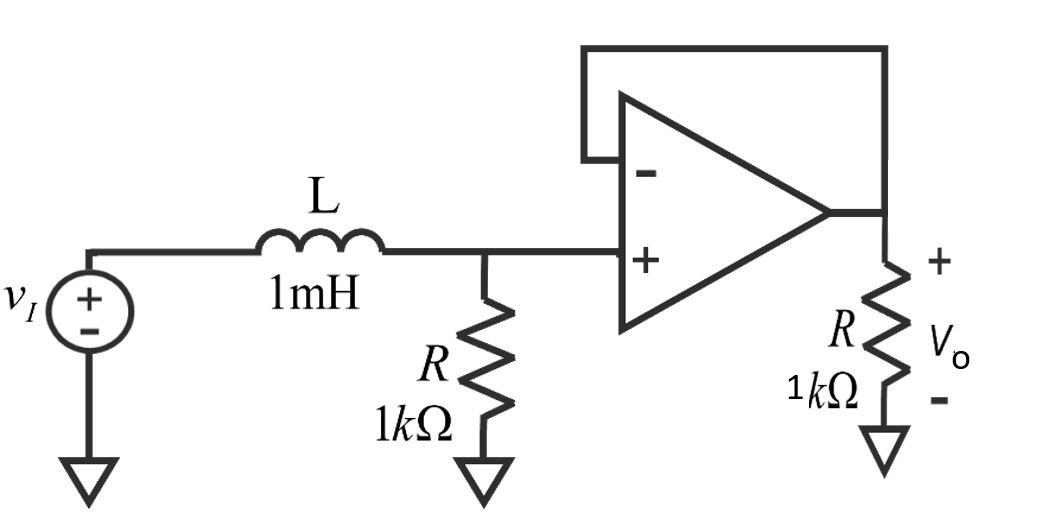


300k Hz Vin and V1 waveform, turn off OP.

(1pic)

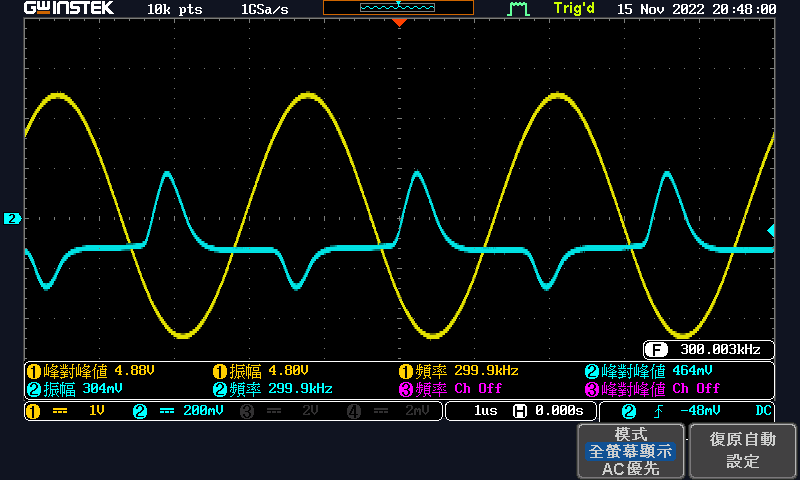


4.



300k Hz Vin and Vo waveform

(1pic)

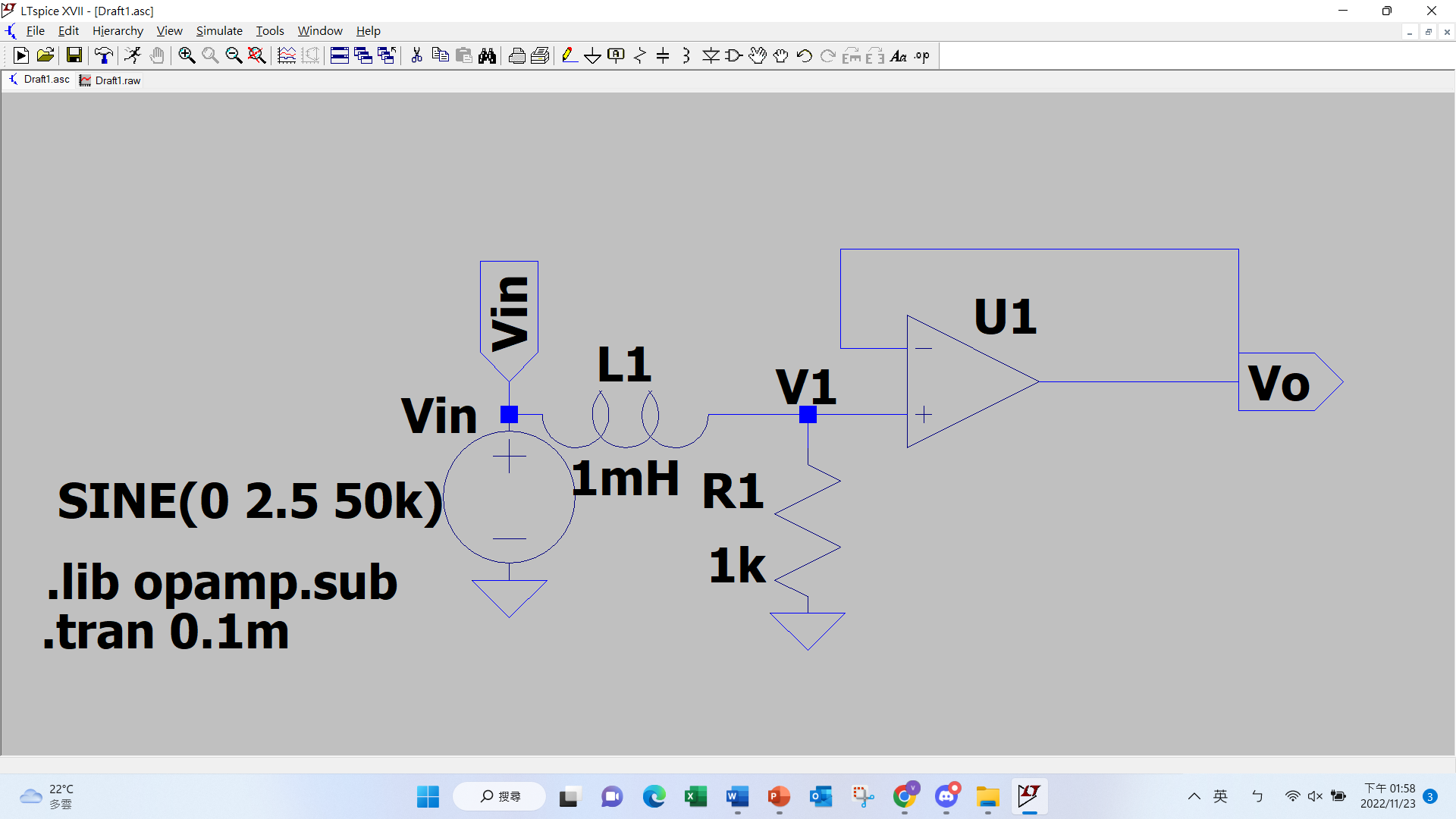


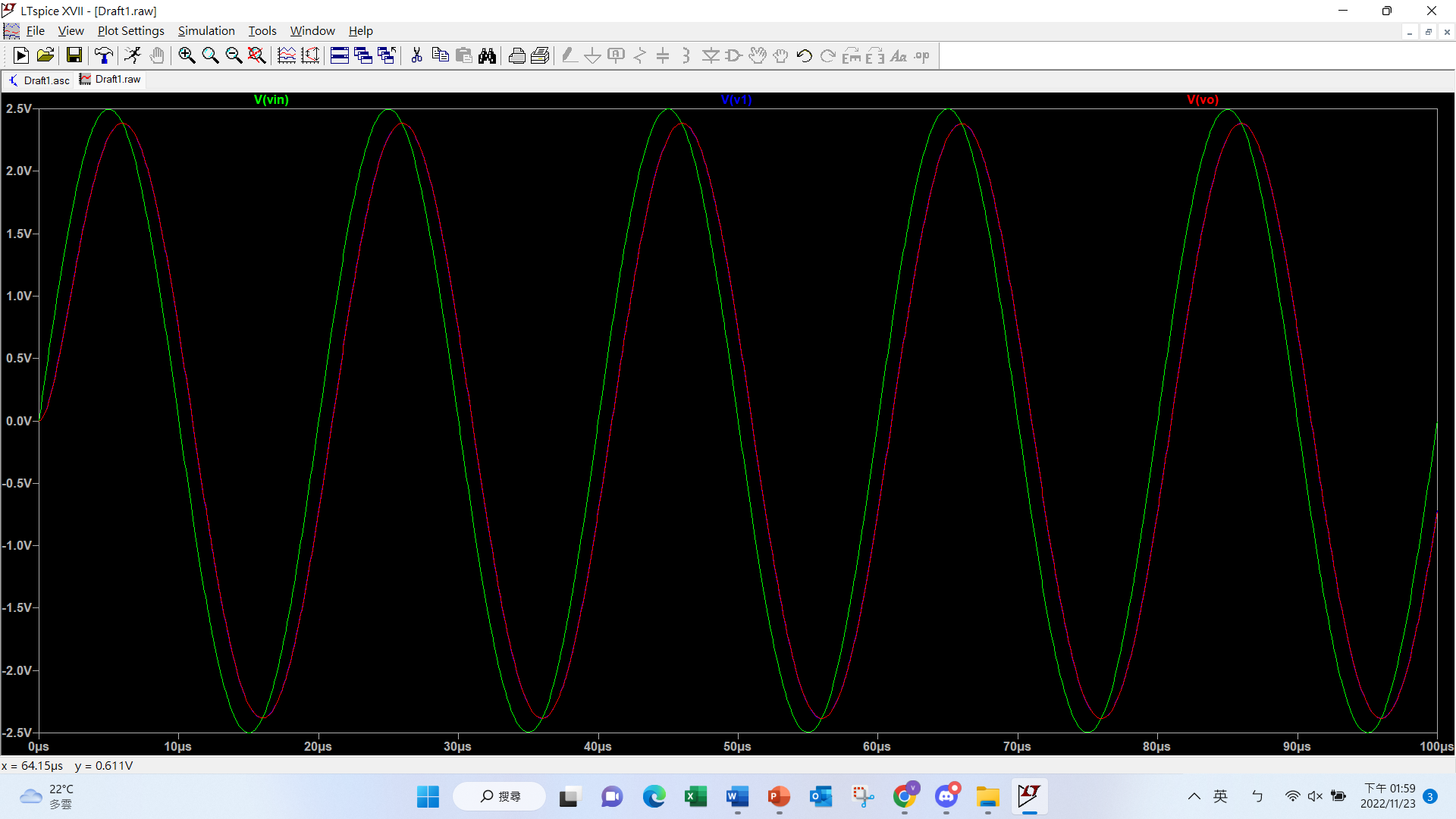
Question:

Please attach your LTSPICE simulation result. (Both schematic and waveform)

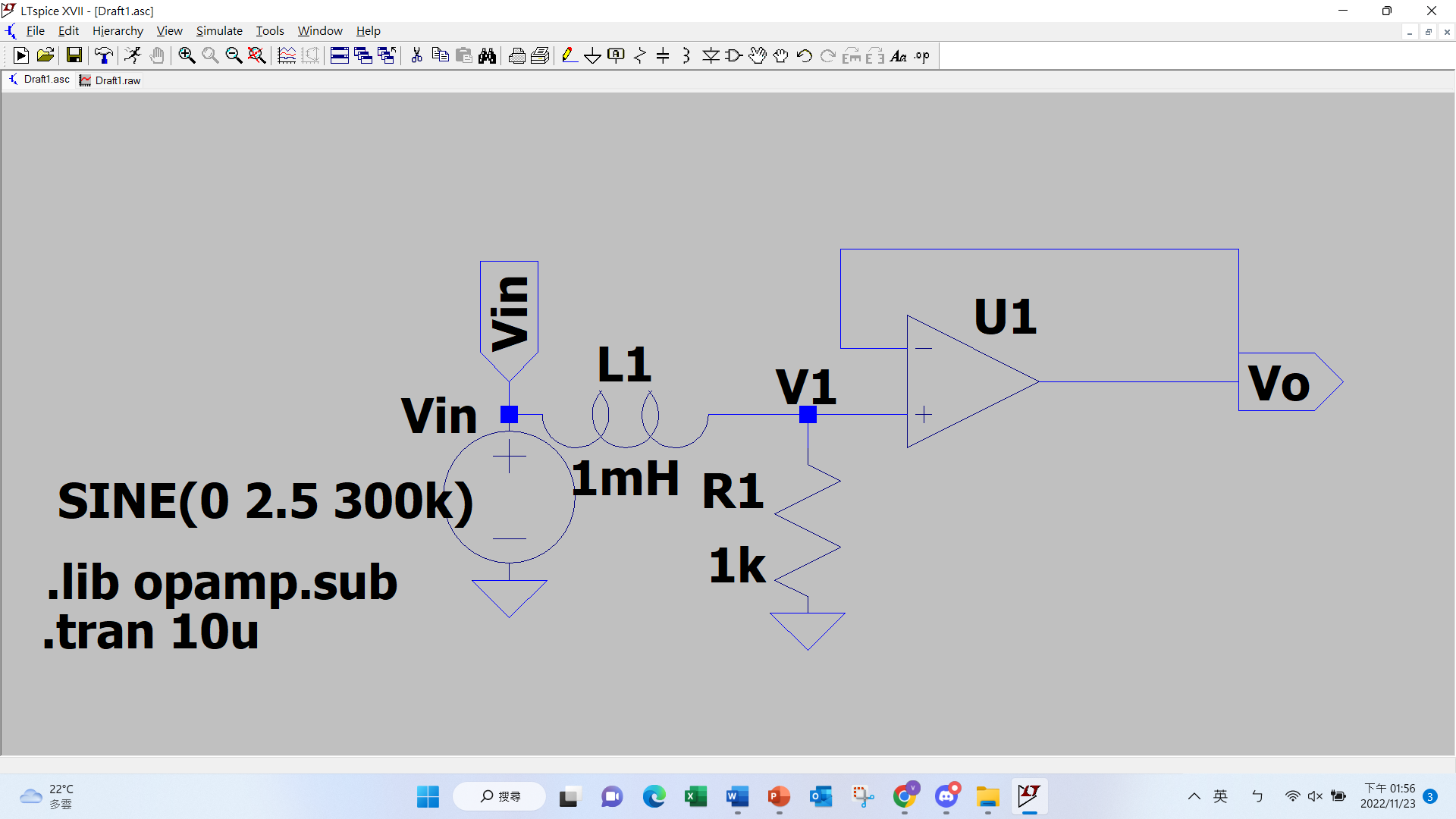
(2pic)

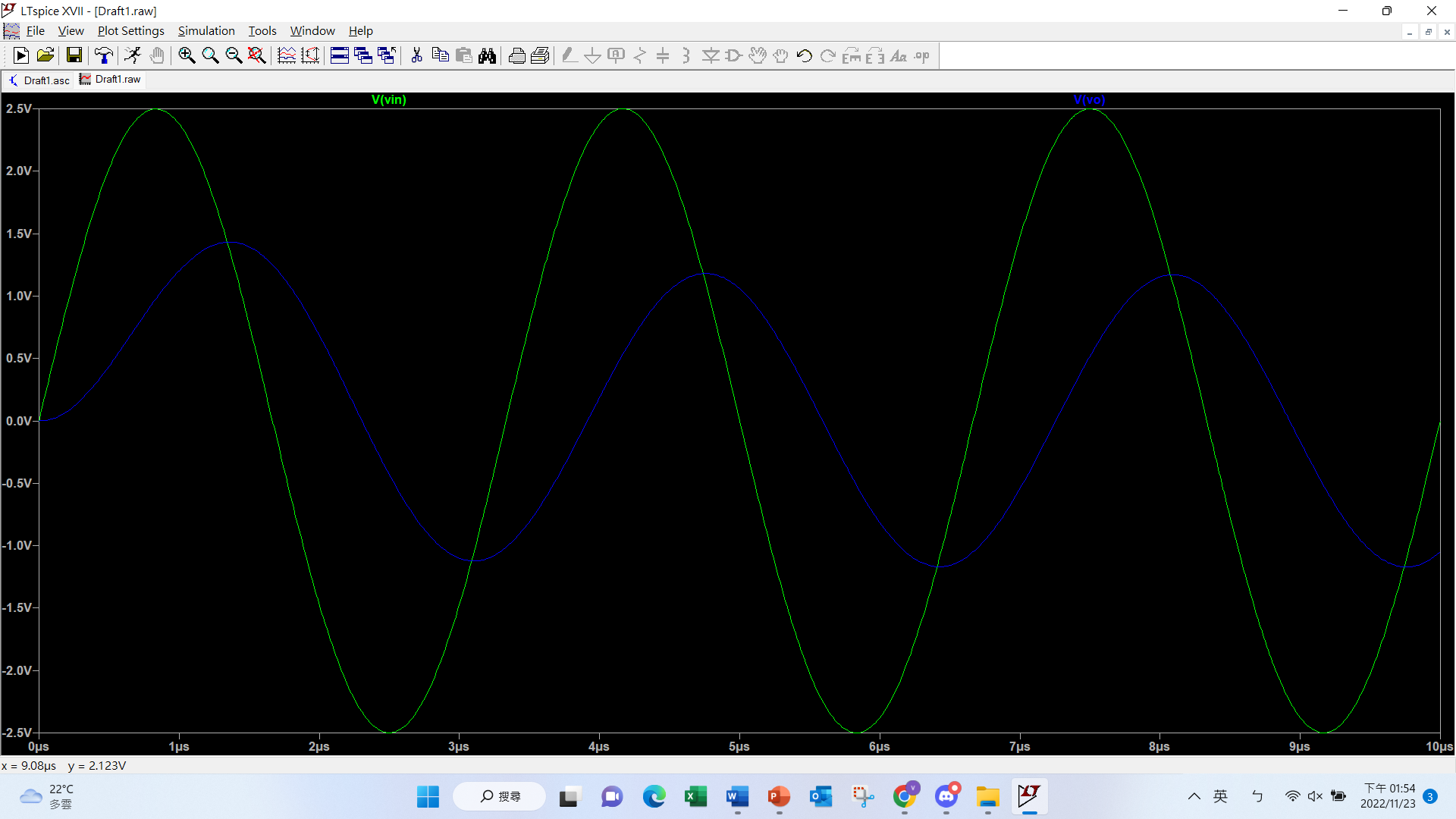
First circuit with 50kHz sine wave:



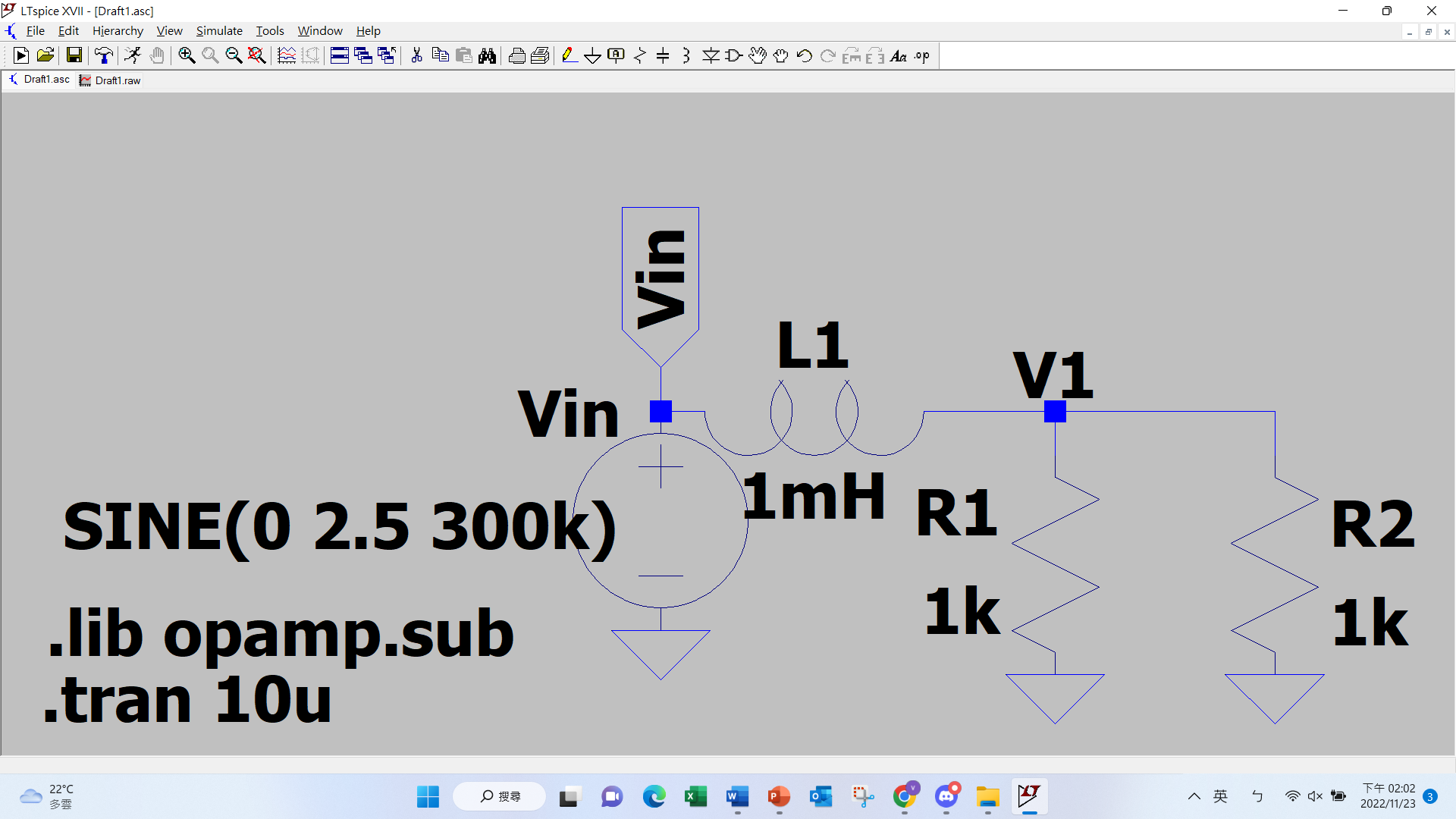


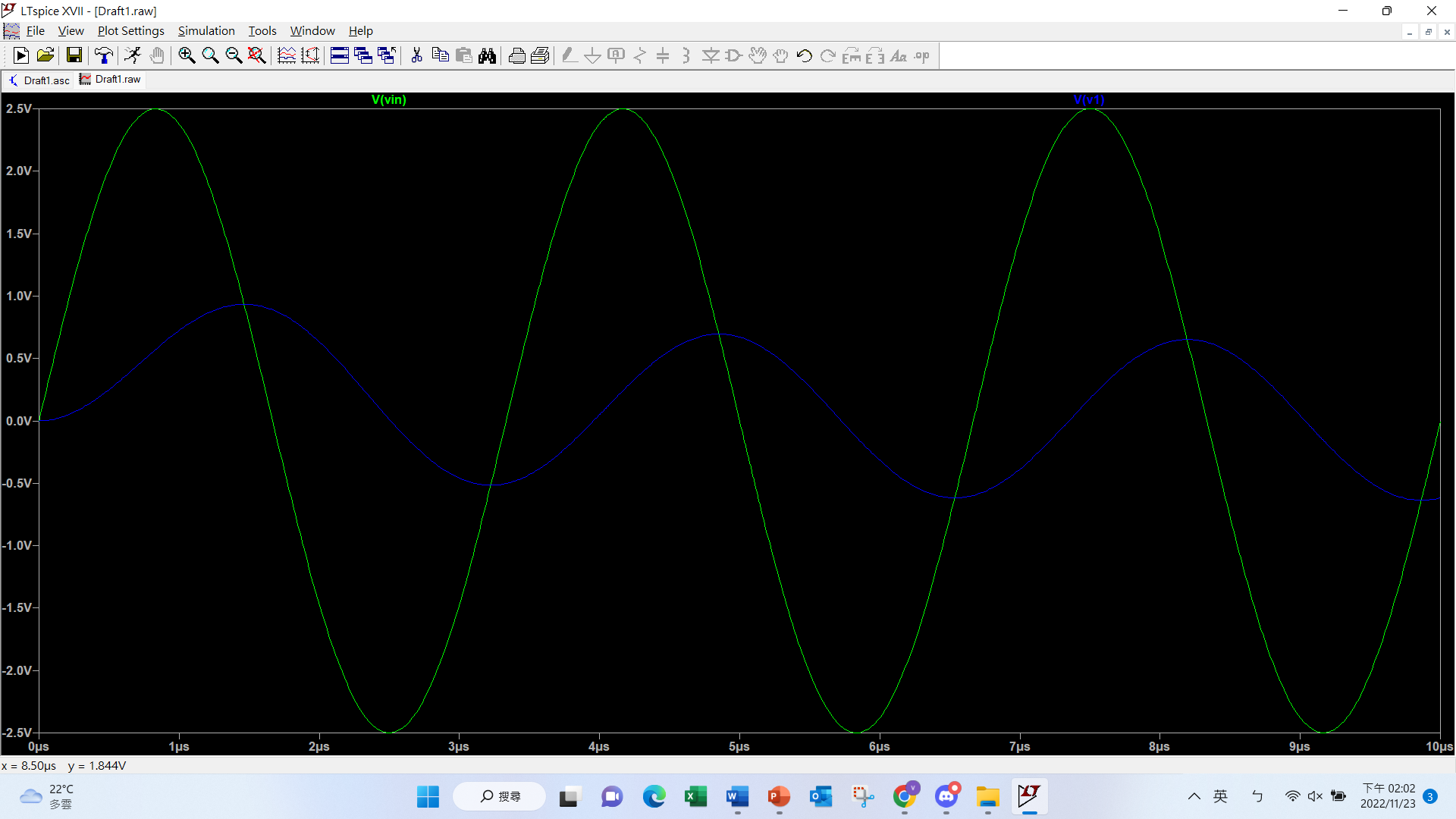
First circuit with 300kHz sine wave:



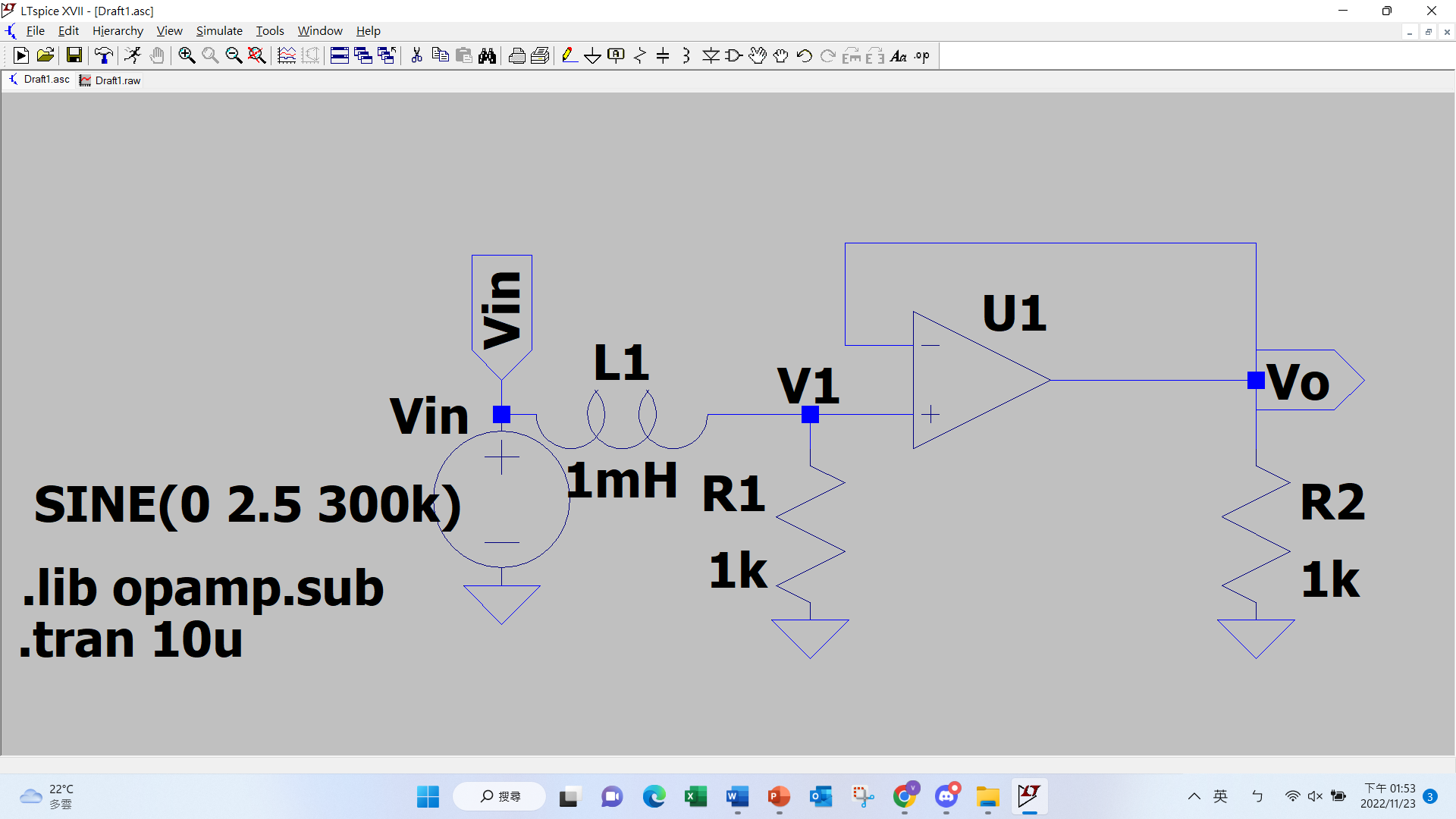


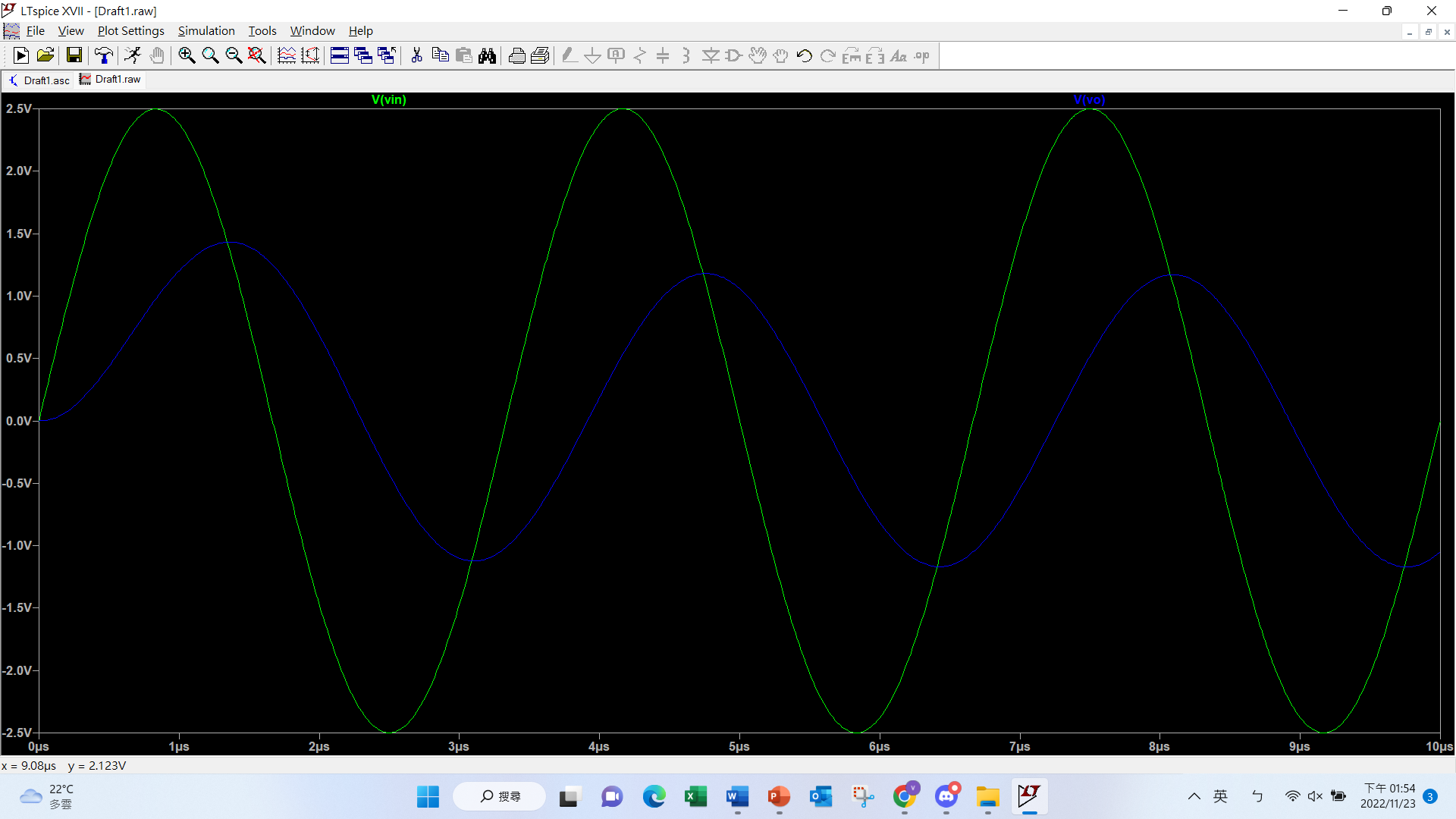
Second circuit, which is the one without the operational amplifier:





Third circuit:





Discuss:

This circuit is composed of a low-pass filter and a voltage follower. The experiment let us try using with and without the voltage follower.

In the simulation, we find out that the voltage is different when we didn’t use the voltage follower. In this case, the resistance and is considered parallel. If the voltage follower is used, the low-pass filter will ignore , and consider as open circuit.

In experiment, the same situation occurs. However, there is a strange waveform in the 4th picture. After some research:

<https://www.electronics-tutorials.ws/amplifier/amp_7.html>

We think this is because “crossover distortion”. This may happen in some amplifiers.

<https://en.wikipedia.org/wiki/Crossover_distortion>