Lab 3

VE311 - Electronic Circuits Fall 2021

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3.1

3.1.1

First, the simulation diagram is attached here.

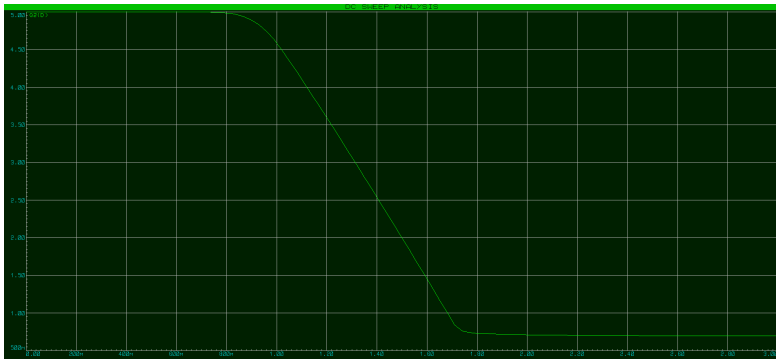

Figure 1: problem 1.1 simulation

The voltage gain is about $A_v = 5.3$, which is close to $\dfrac{R_D}{R_S} = 5$.

3.1.2

The simulation is attached as follows.

The theoretical voltage gain is about

$$\frac{4.368 - 4.33}{0.01} = 3.8$$

And then we can calculate the voltage gain. It's about

$$\frac{0.114}{2 \times 0.01} = 5.7$$

which is slightly larger than the theoretical value 3.5. This may be because the input signal amplitude is too small and there is obvious noise, so the waveform is not clear, and there are errors in reading.

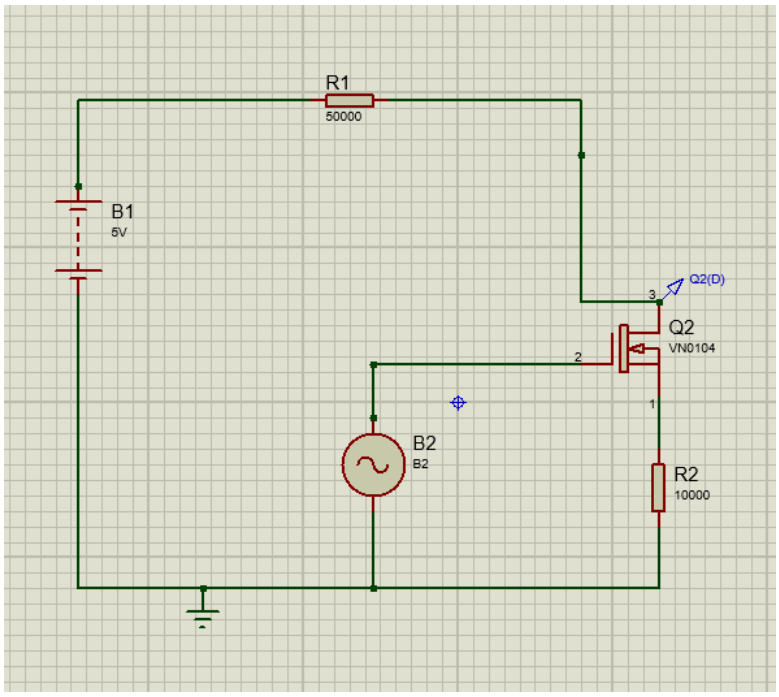

Figure 2: problem 1.2 circuit

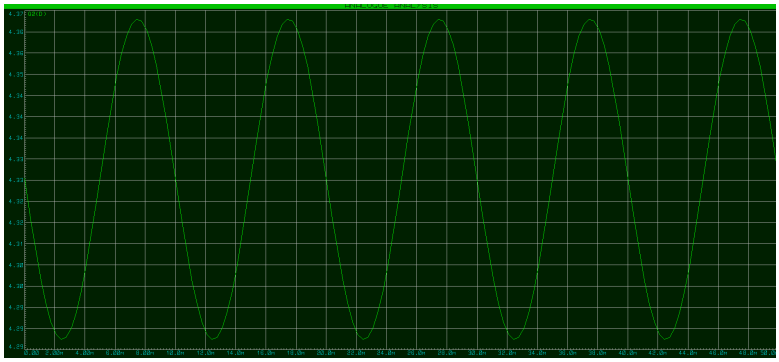

Figure 3: problem 1.2 simulation

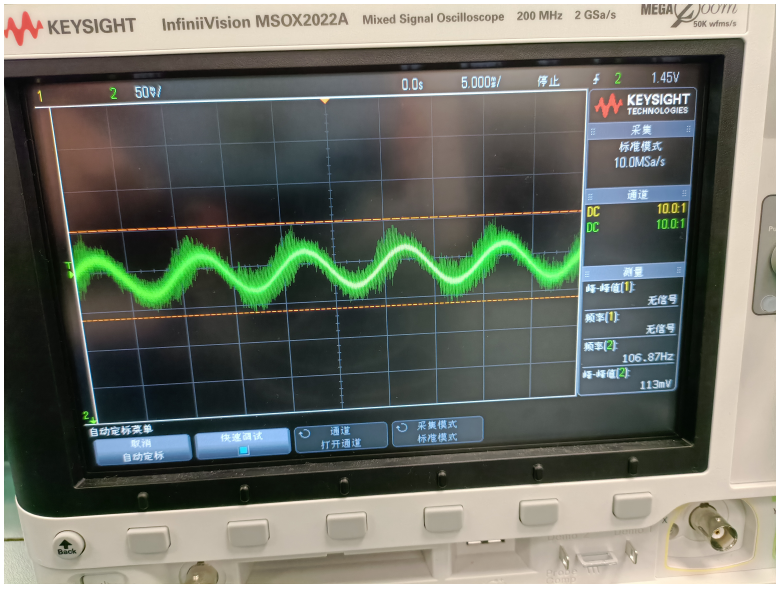

Figure 4: problem 1.2 experiment

3.1.3

The simulation is attached as follows.

The theoretical voltage gain is about

$$\frac{2.199 - 2.18}{0.01} = 1.9$$

which is significantly smaller than 5. It can be explained by the existence of an additional load connected in series with the amplifier, which reduces the output voltage. And then we can calculate

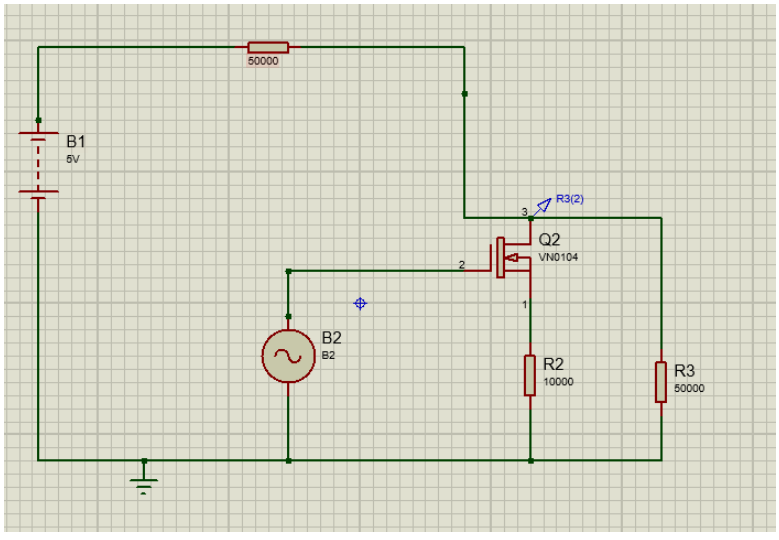

Figure 5: problem 1.3 circuit

the voltage gain. It's about

$$\frac{0.077}{2 \times 0.01} = 3.8$$

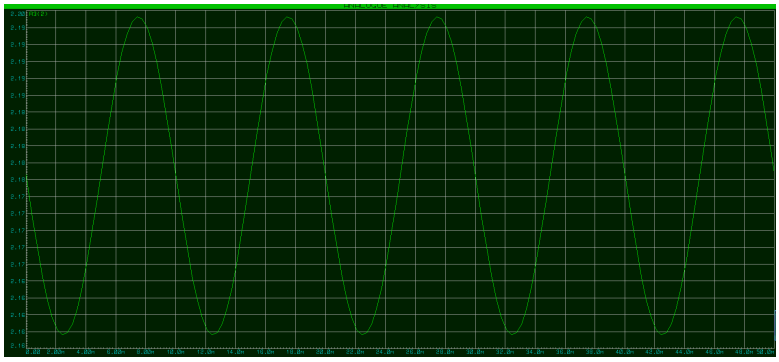

Figure 6: problem 1.3 simulation

which is larger than the theoretical value 1.9. This may be because the input signal amplitude is too small and there is obvious noise, so the waveform is not clear, and there are errors in reading. At the same time, since there is no 50kΩ resistance in the laboratory, we used two 91kΩ resistances in parallel with each other, there may be some error.

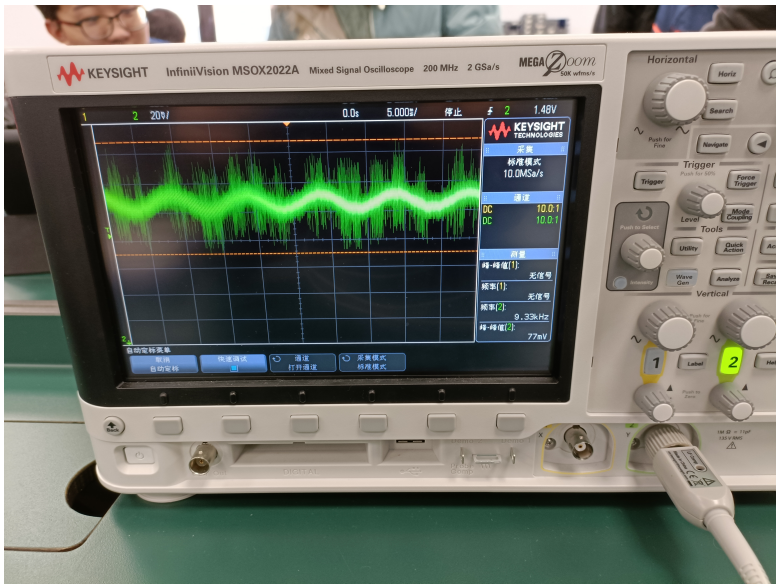

Figure 7: problem 1.3 experiment

3.2

3.2.1

First, the simulation diagram is attached here.

The voltage gain is about $A_v = 0.96,$ which is close to 1.

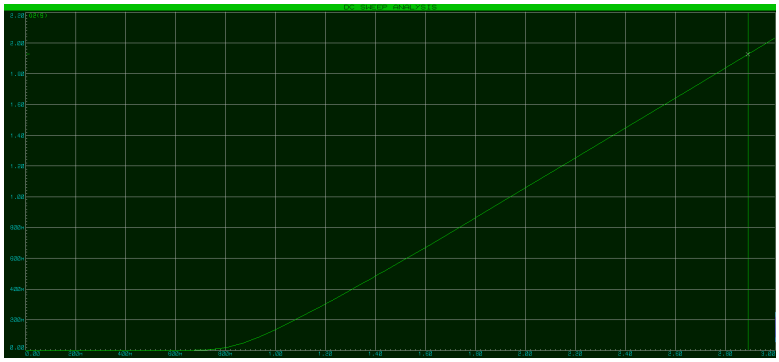

Figure 8: problem 2.1 simulation

3.2.2

The simulation is attached as follows.

The theoretical voltage gain is about

$$\frac{1.107 - 1.058}{0.05} = 0.98$$

which is similar to 1. And then we can calculate the voltage gain. It's about

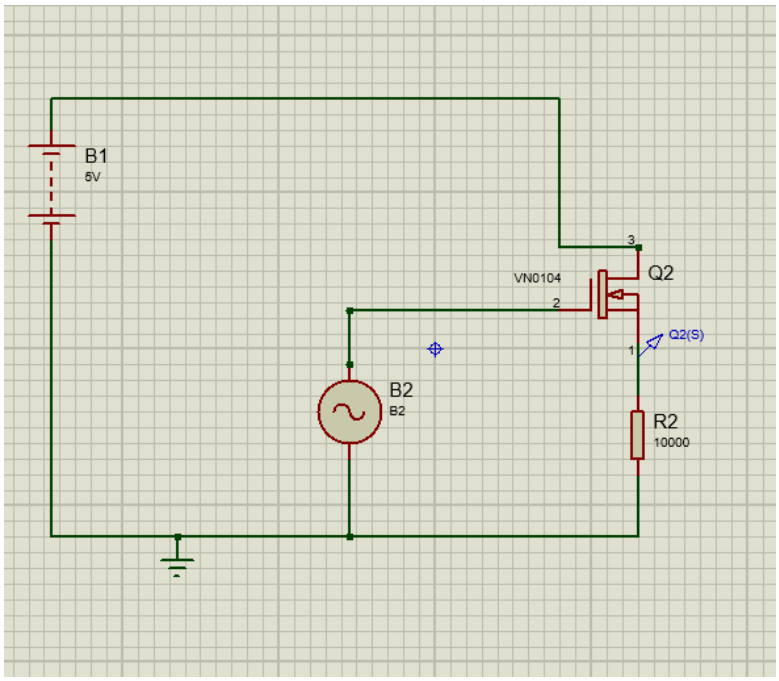

Figure 9: problem 2.2 circuit

$$\frac{0.098}{2 \times 0.05} = 0.98$$

which is similar to the theoretical value 0.98.

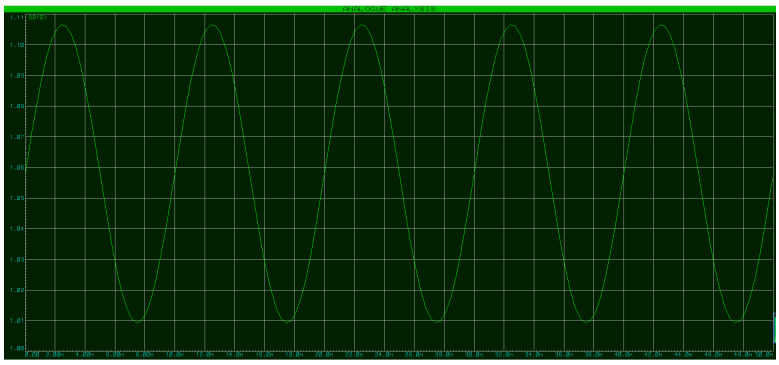

Figure 10: problem 2.2 simulation

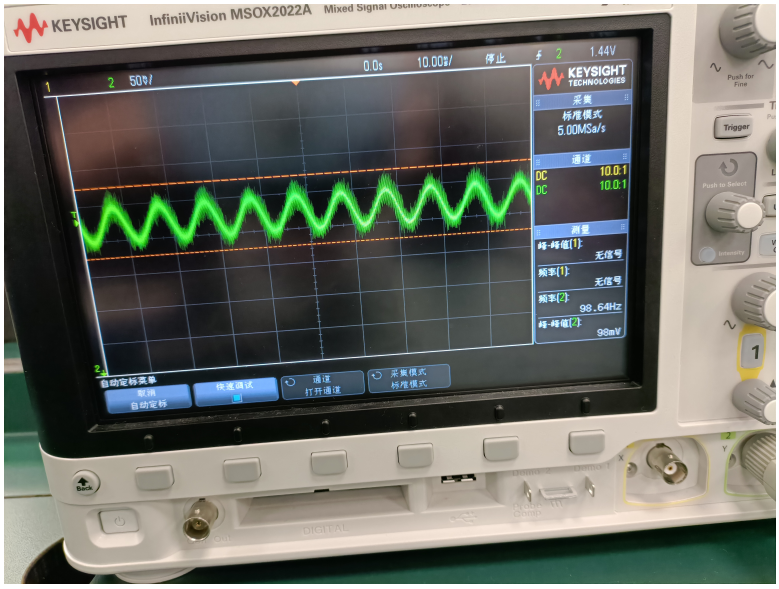

Figure 11: problem 2.2 experiment

3.2.3

The simulation is attached as follows.

The theoretical voltage gain is about

$$\frac{1.102 - 1.052}{0.05} = 1$$

which is similar to 1. It can be explained by the existence of an additional load connected in series with the amplifier, which reduces the output voltage. And then we can calculate the voltage gain.

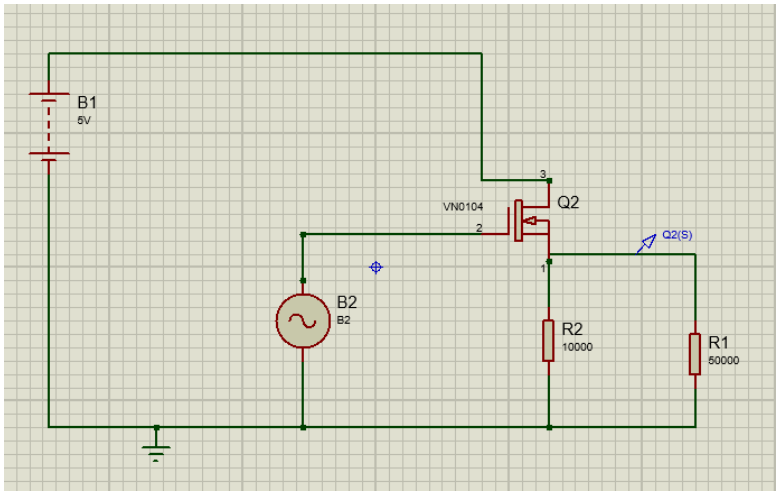

Figure 12: problem 2.3 circuit

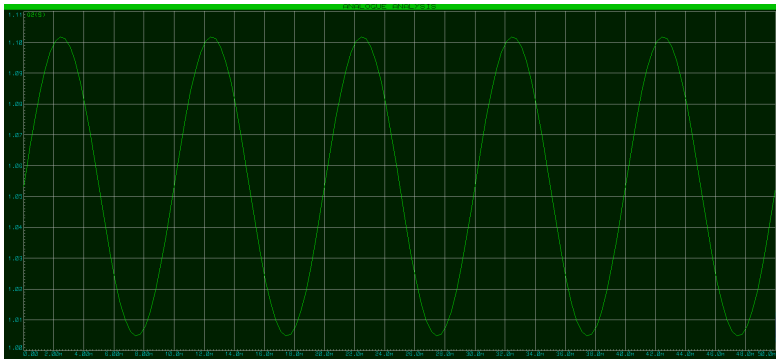

Figure 13: problem 2.3 simulation

It's about

$$\frac{0.085}{2 \times 0.05} = 0.85$$

which is smaller than the theoretical value 1. This may be because the input signal amplitude is too small and there is obvious noise, so the waveform is not clear, and there are errors in reading. At the same time, since there is no 50kΩ resistance in the laboratory, we used two 91kΩ resistances in parallel with each other, there may be some error. And the existence of the additional load connected in series with the amplifier decreases the output voltage.

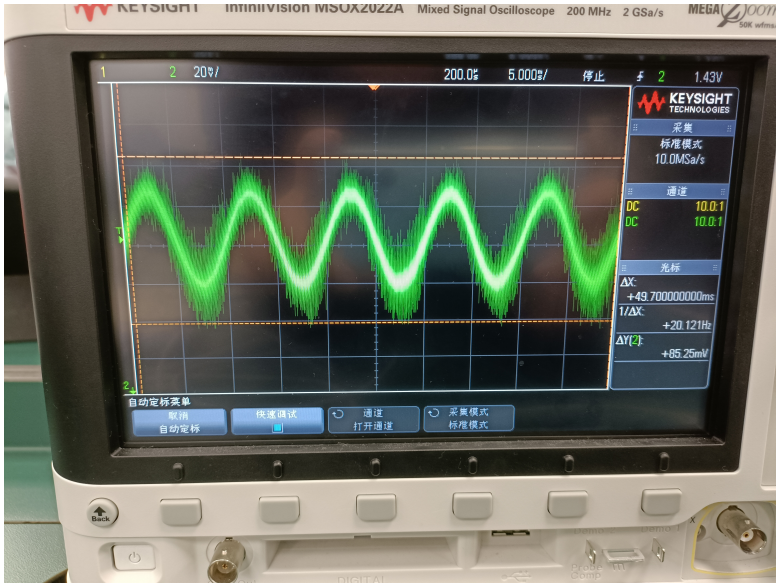

Figure 14: problem 2.3 experiment