

Lab 4

VE311 - Electronic Circuits Fall 2021

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4.1

4.1.1

The simulation is attached as follows.



Figure 1: problem 1.1 simulation

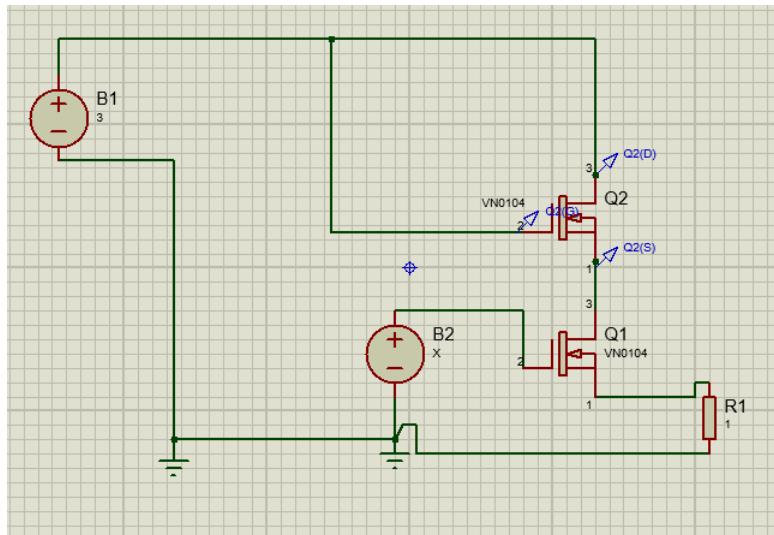


Figure 2: problem 1.1 circuit

The voltage gain is about $|A_v| = \frac{2.4 - 2}{0.8 - 0.4} = 1$, which is close to the theoretical value.

And the experimental value is as follows.

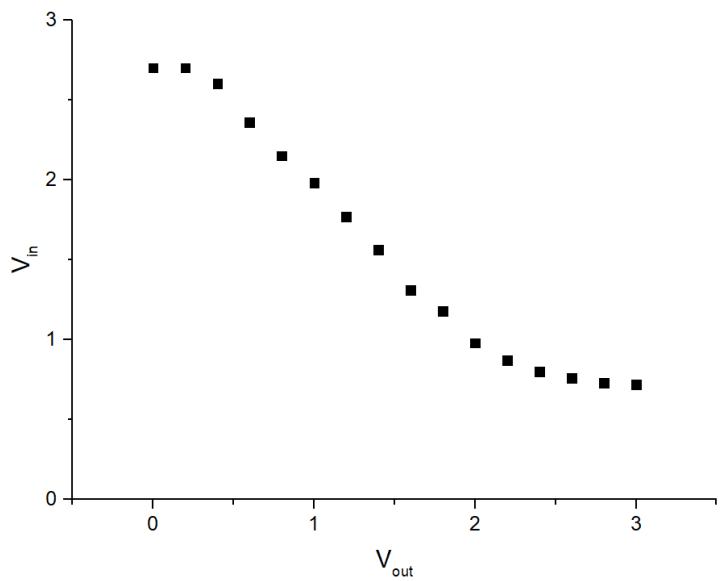


Figure 3: problem 1.1 dc-sweep experiment



Figure 4: problem 1.2 simulation

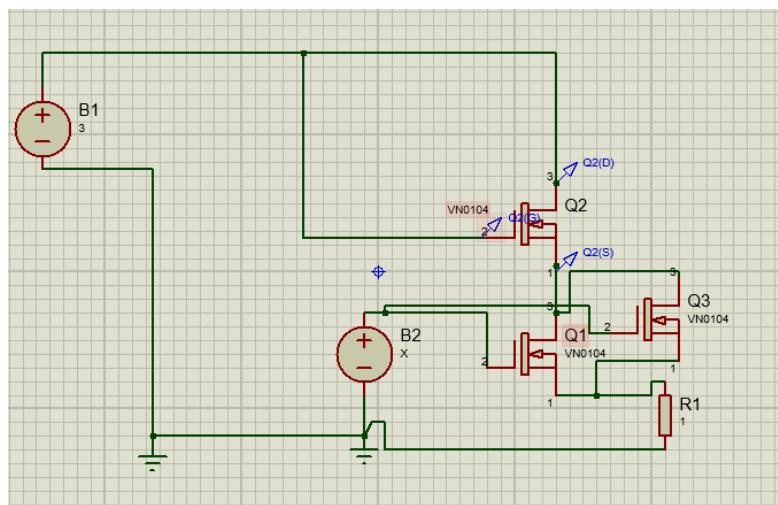


Figure 5: problem 1.2 circuit

4.1.2

The simulation is attached as follows.

The voltage gain is about $|A_v| = \frac{1.68 - 1.16}{1.6 - 1.2} = 1.3$, which is larger than 1 but smaller than 2.

Because we may ignore channel length modulation and body effect when calculating it. And the experimental value is as follows.

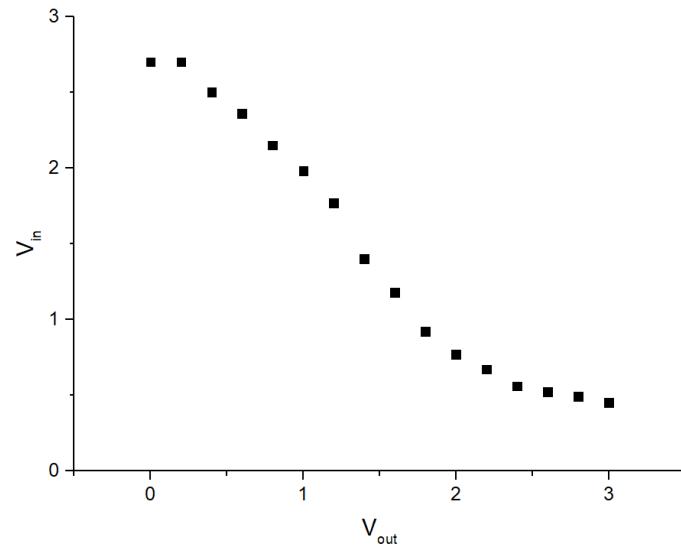


Figure 6: problem 1.2 dc-sweep experiment

4.1.3

The simulation is attached as follows.

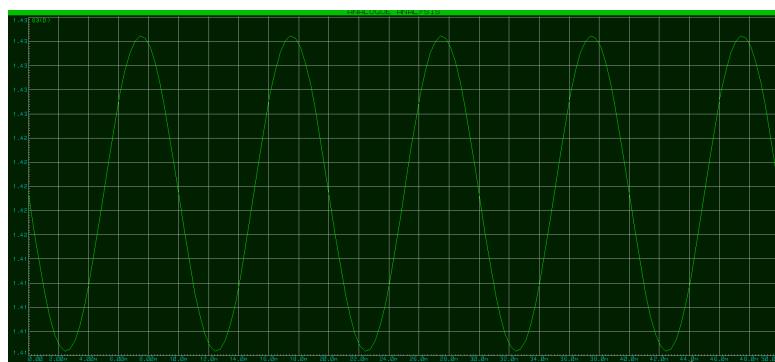


Figure 7: problem 1.3 simulation

The voltage output is about $v_{out} = 1.4364 - 1.4234 = 0.013$,

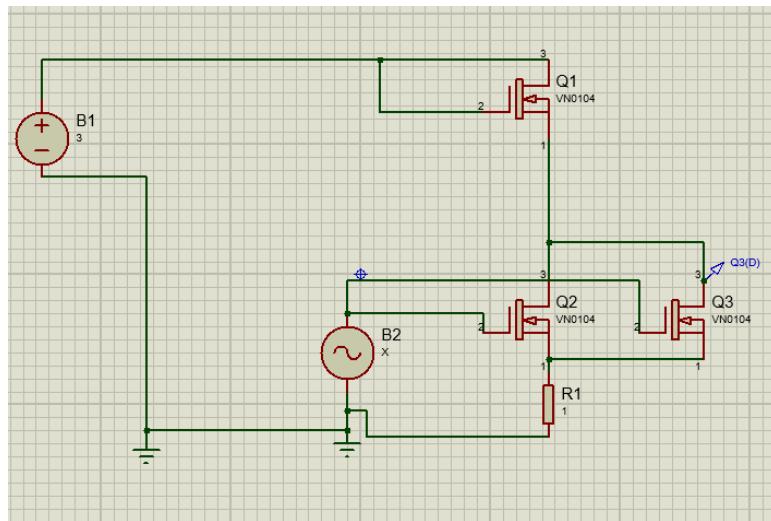


Figure 8: problem 1.3 circuit

The voltage gain is about $|A_v| = \frac{0.013}{0.01} = 1.3$, which is the same as the theoretical value.

And the experimental value is as follows. We can see that the experimental value is about 3.5, which

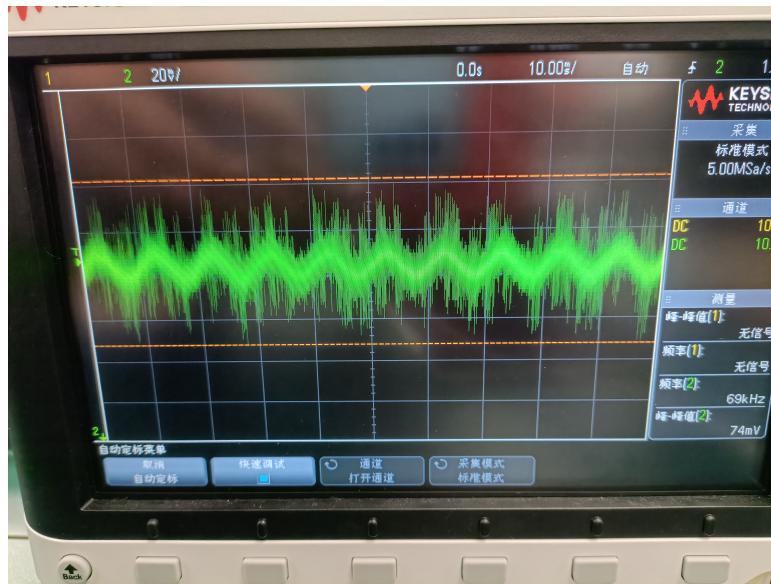


Figure 9: problem 1.3 experiment

is higher than theoretical value and there is a lot of noise. This may be due to aging of the device, internal resistance, etc.

4.2

4.2.1

The simulation is attached as follows.



Figure 10: problem 2.1 simulation

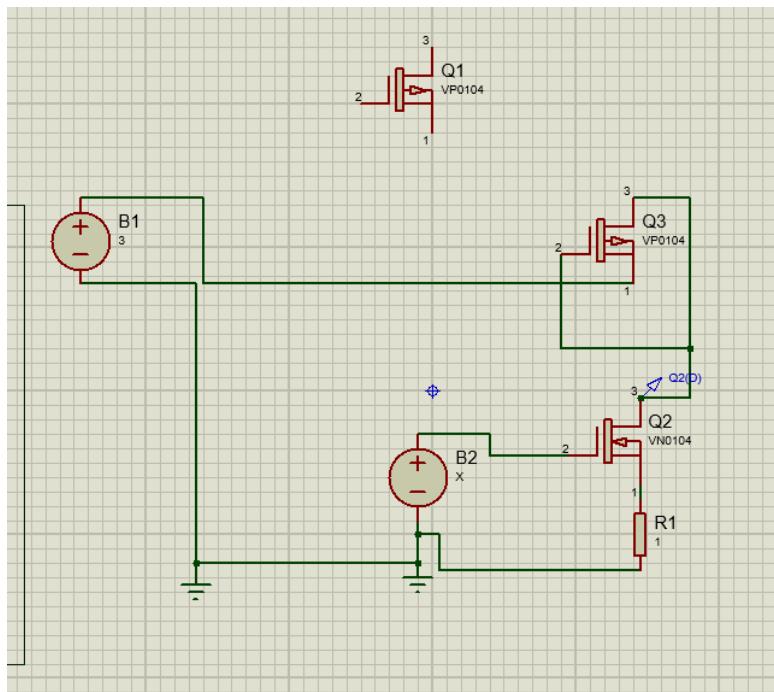


Figure 11: problem 2.1 circuit

The voltage gain is about $|A_v| = \frac{1.3 - 0.58}{0.8 - 0.4} = 1.8$, which is close to the theoretical value.

And the experimental value is as follows.

4.2.2

The simulation is attached as follows.

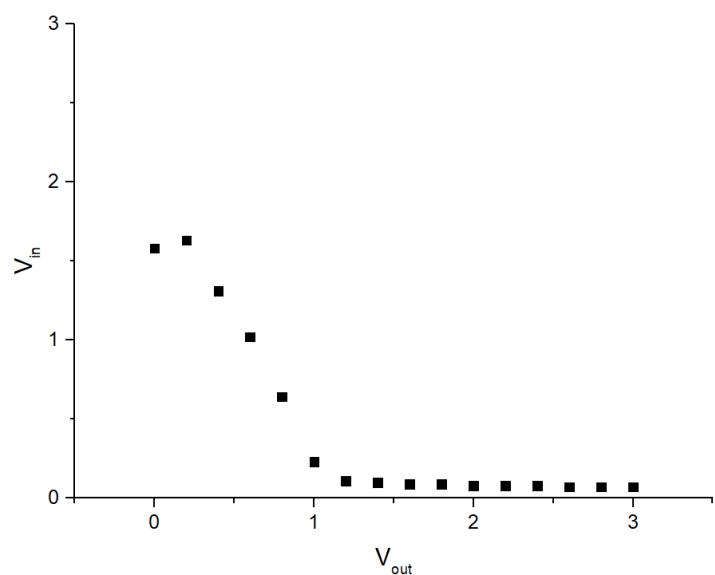


Figure 12: problem 2.1 dc-sweep experiment

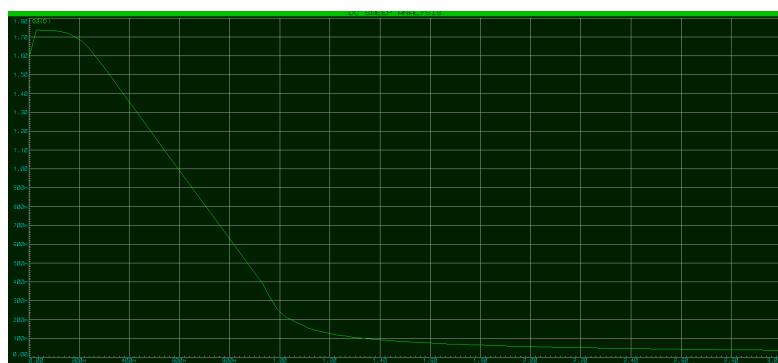


Figure 13: problem 2.2 simulation

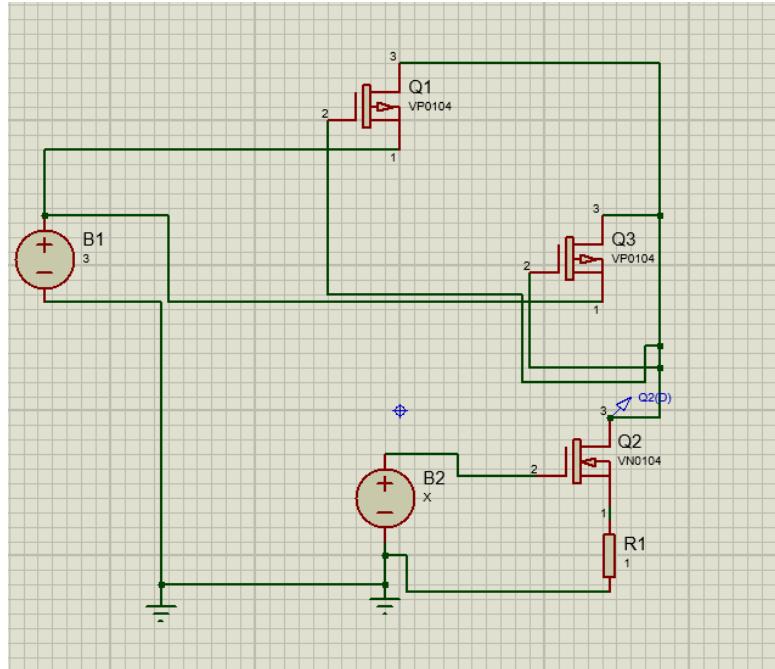


Figure 14: problem 2.2 circuit

The voltage gain is about $|A_v| = \frac{1.35 - 0.64}{0.8 - 0.4} = 1.775$, which is close to the value in the last part.

Because connecting two diode-type mosfets in parallel does not affect the amplitude of the output voltage. And the experimental value is as follows.

4.2.3

The simulation is attached as follows.

The voltage output is about $v_{out} = 1.0096 - 0.992 = 0.0176$,

The voltage gain is about $|A_v| = \frac{0.0176}{0.01} = 1.76$, which is almost the same as the theoretical value.

And the experimental value is as follows. We can see that the experimental value is about 2.7, which is higher than theoretical value and there is a lot of noise. This may be due to aging of the device, internal resistance, etc.

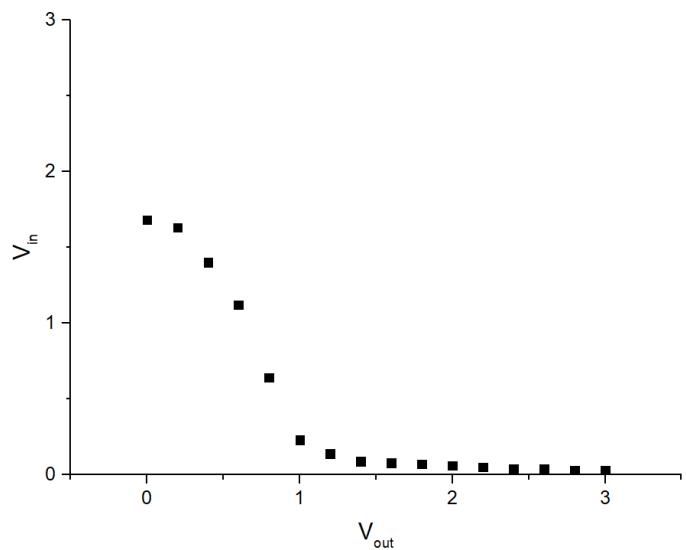


Figure 15: problem 2.2 dc-sweep experiment

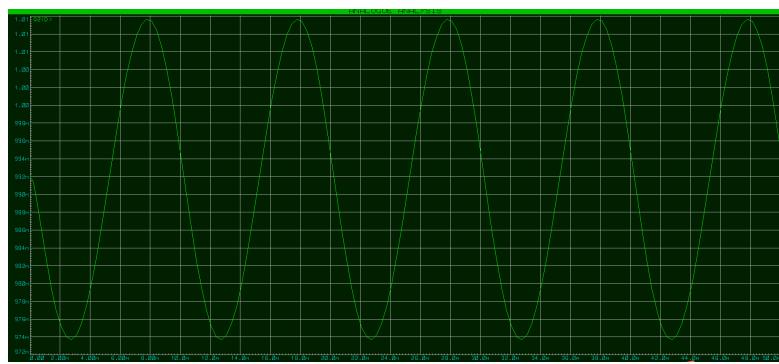


Figure 16: problem 2.3 simulation

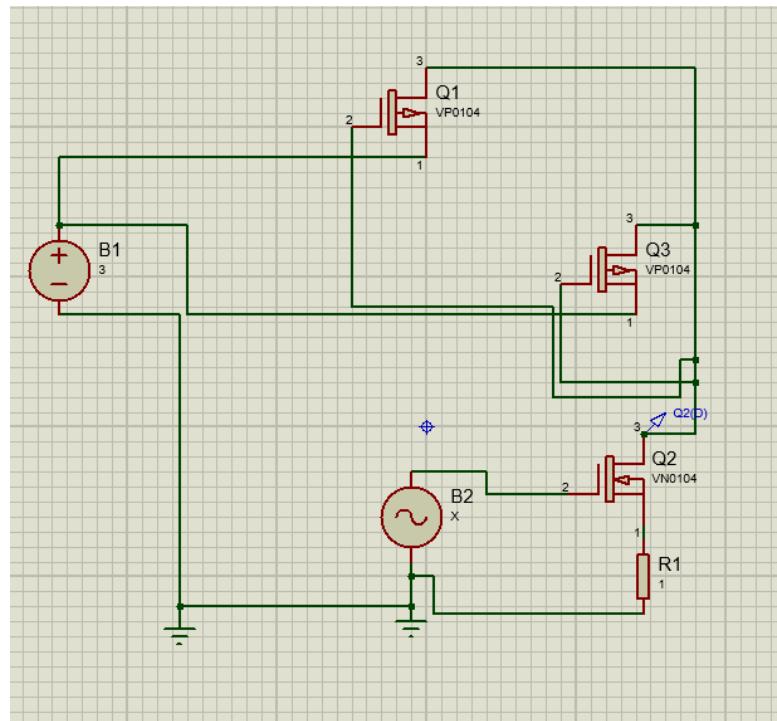


Figure 17: problem 2.3 circuit

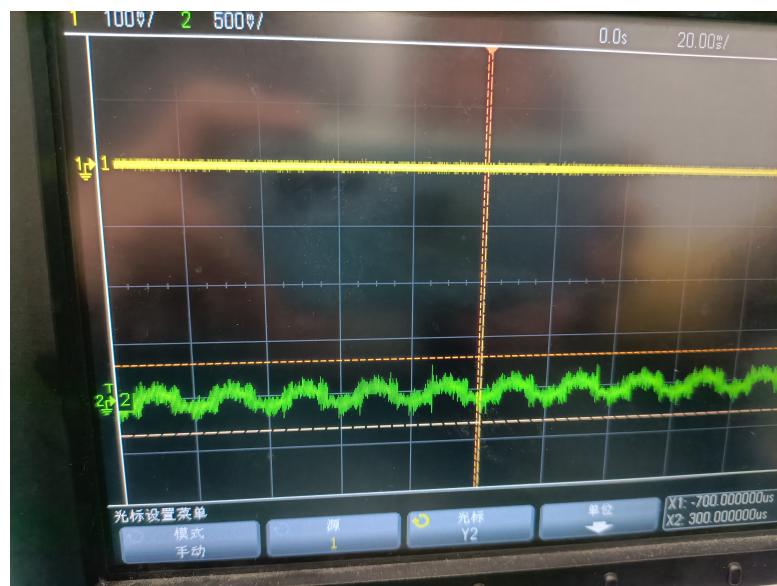


Figure 18: problem 2.3 experiment