Lab 1

VE311 - Electronic Circuits Fall 2021

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1.1

1.1.1 Simulation

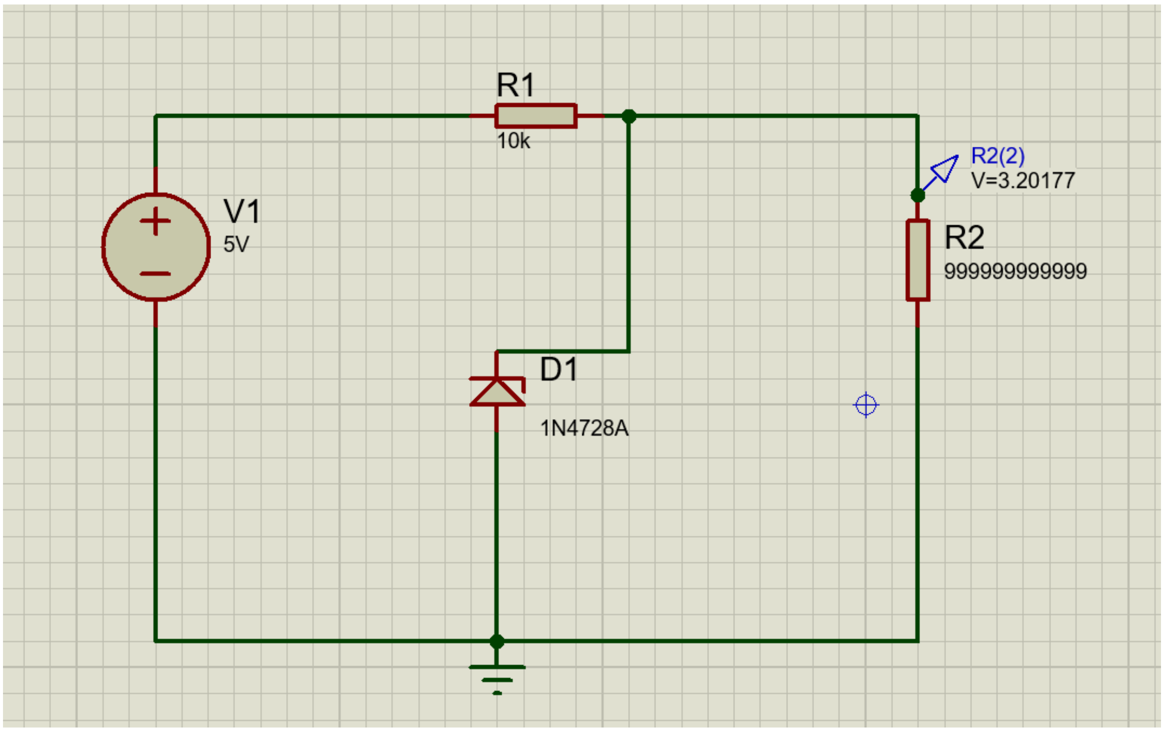

Figure 1: problem 1.1

We simulate the desired circuit in Proteus. It is known that $V_S = 5$ V, $R = 10$k and $R_L = \infty$. From the simulation, we know that $V_L = 3.2$ V.

1.1.2 In lab

See the figure below

1.1.3 Discussion

The values from experiment is much smaller than that from simulation. The breakdown voltage for 1N4728A is 3.2 V. The difference may result from the low R of the resistor in lab. In that case, the obtained V_L is reasonable.

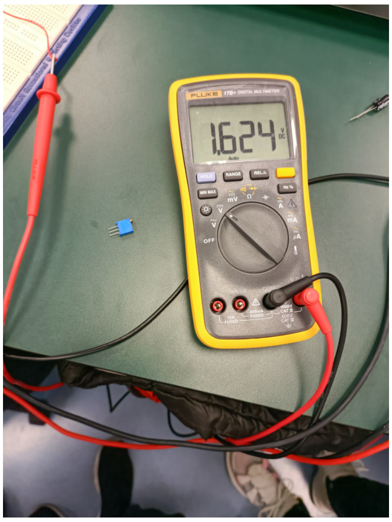

Figure 2: problem 1.2

1.2

1.2.1 Simulation

According to the simulation on the Proteus, it is known that $V_L = 8.25\text{mV}$ and $V_s = 0.5$ V.It can be estimated that $R_z = 83\Omega$.

$$\frac{R_z}{R + R_z} = \frac{17 \times 10^{-3}}{2} = 8.5 \times 10^{-3}$$

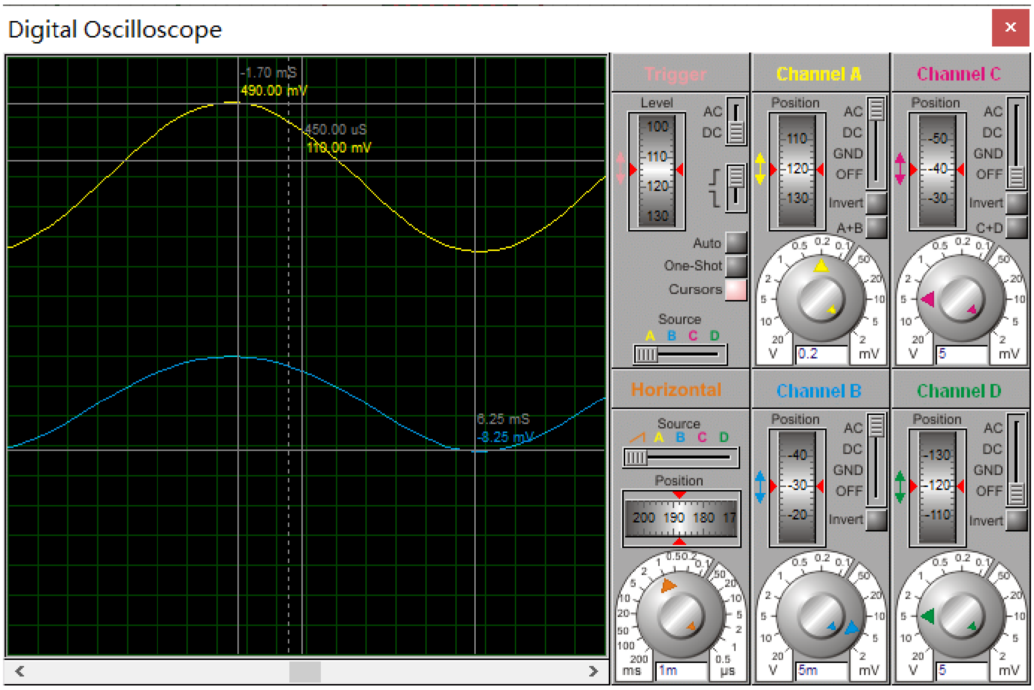

Figure 3: problem 1b

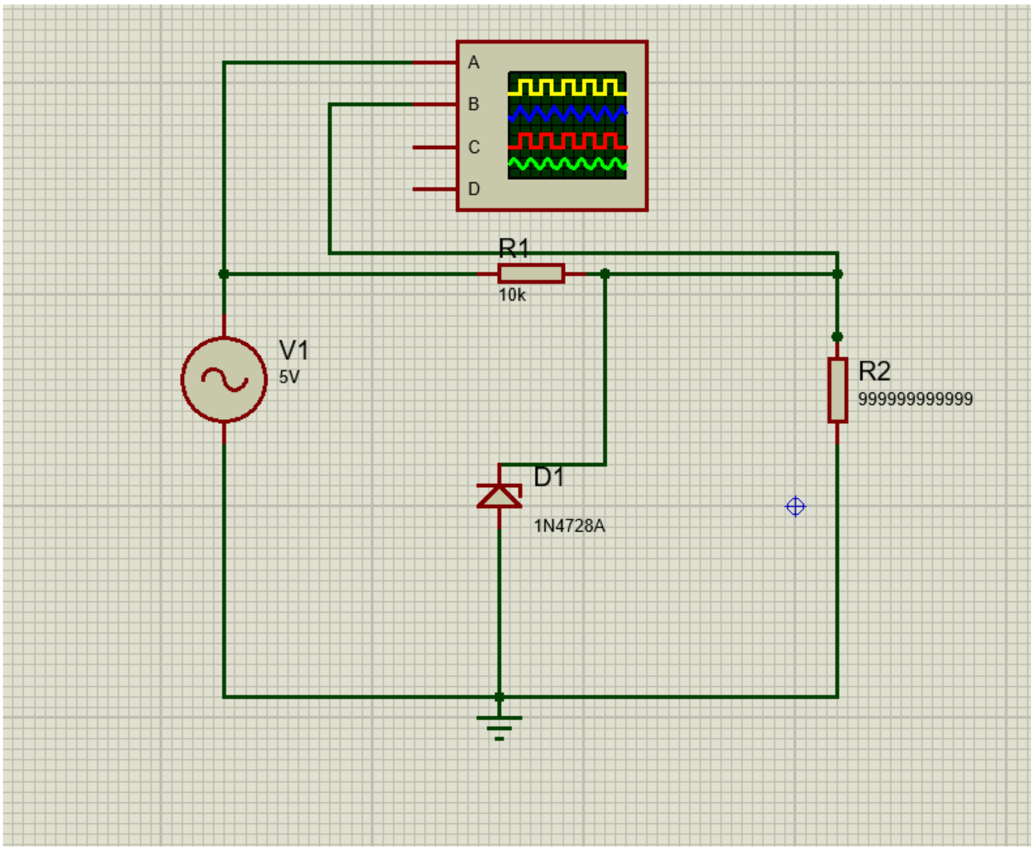

Figure 4: problem 1b

1.2.2 In lab

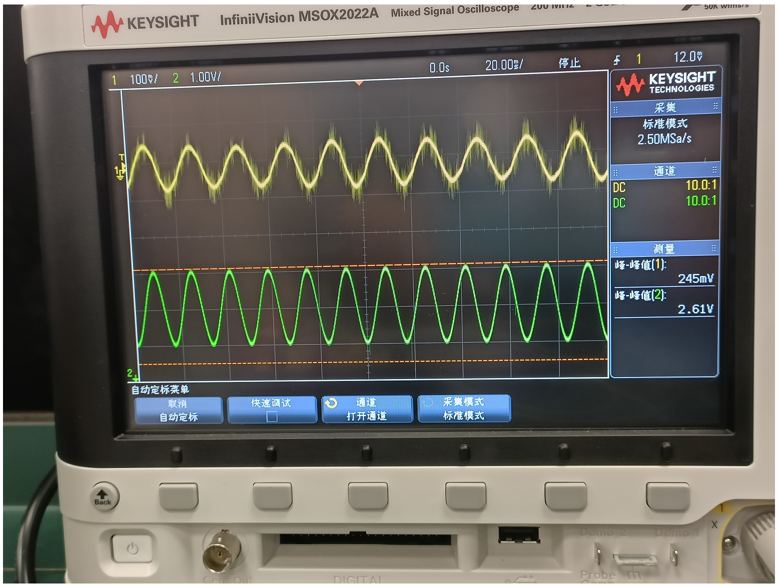

Figure 5: problem 1b

From the result, we can say that line regulation is about 7.7×10^{-2}, and $R_z = 800\Omega$.

1.2.3 Discussion

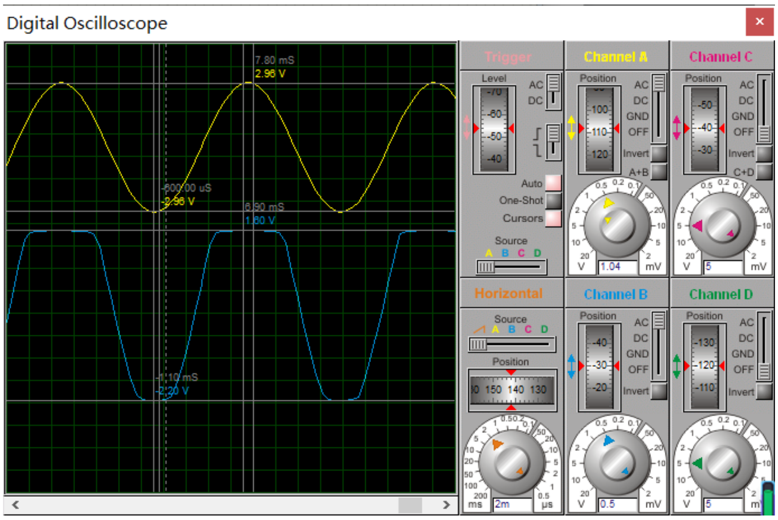

Figure 6: problem 1b

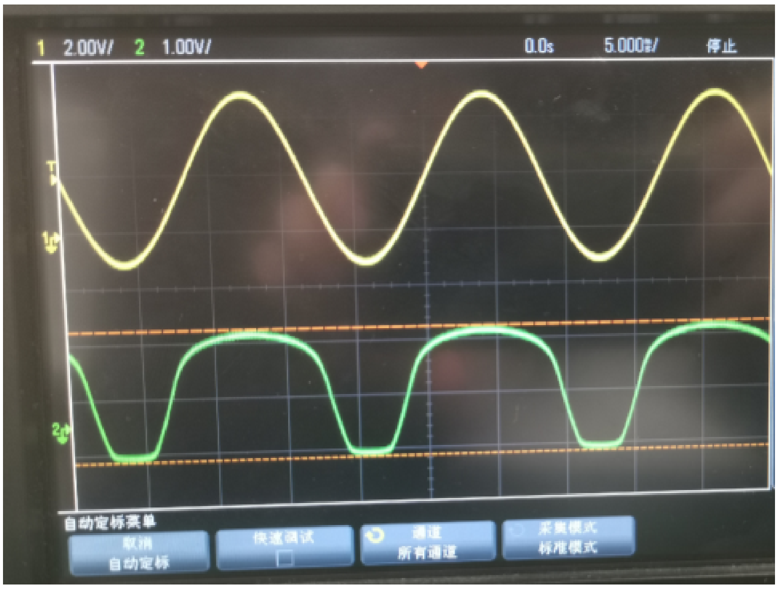

Figure 7: problem 1b

1.3

1.3.1 Simulation

We do simulation on Proteus that when $R_L = 8k\Omega$, the voltage regulator stops working.

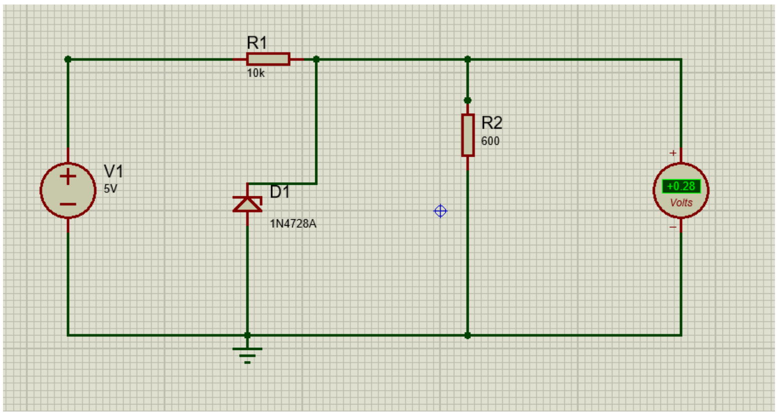

Figure 8: problem 1c

1.3.2 In lab

We do experiment in lab. We find that when $R_L = 9.57k\Omega$,and $V_L = 3.563V$, the voltage regulator stops working.

1.3.3 Discussion

$R_{L,\min}$ is found to be $9k\Omega$ according to the experimental value and the simulated value.

2 Half-Wave Rectifier

2.1

2.1.1 Simulation

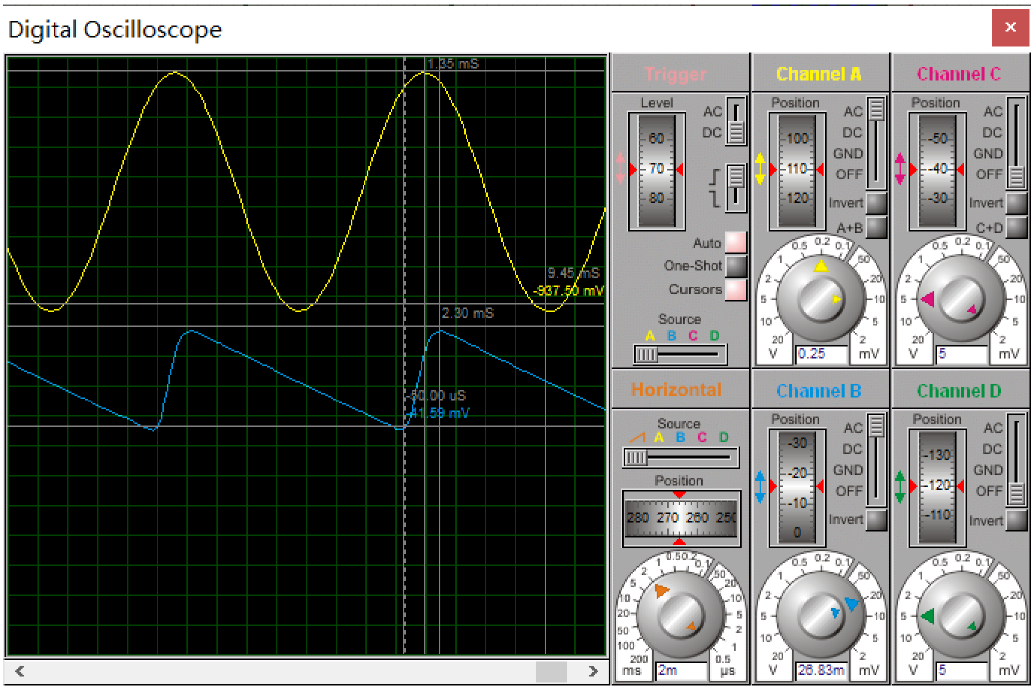

Figure 9: problem 2

$$V_{dc} = 4V$$
$$I_{dc} = 4 \times 10^{-3} A$$
$$\Delta T = 9.84 \times 10^{-4} s$$
$$I_{\text{peak}} = 0.124 \text{ A}$$
$$I_{\text{surge}} = 0.52 \text{ A}$$
$$PIV = 7.75 \text{ V}$$

2.1.2

We set $C = 330\mu$F.

$$V_{dc} = 3.7 \text{ V}$$
$$I_{dc} = 3.7 \times 10^{-3} \text{ A}$$
$$\Delta T = 9.73 \times 10^{-4} \text{ s}$$
$$I_{\text{peak}} = 0.1533 \text{ A}$$
$$I_{\text{surge}} = 0.61 \text{ A}$$
$$PIV = 7.2 \text{ V}$$

We find that the line is inverted, it may because that our line is reversed or the output line is wrong.

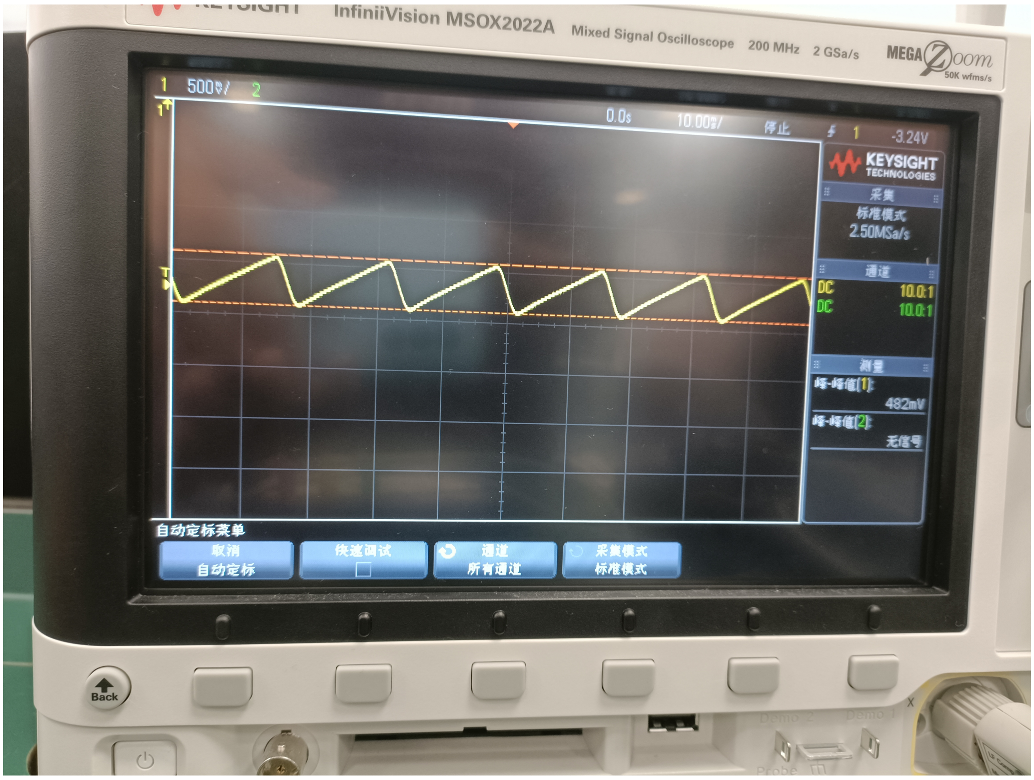

Figure 10: problem 2

2.1.3 Discussion

$$V_r \approx (V_S - V_{on}) \frac{T}{RC}$$

All the parameter values are consistent that the experimental is consistent with simulation result. And ω doubling leads to the half of T, V_r .