Experiment #2 – Diodes and Applications

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# EEE3307 Electronics I

Section 0014

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# **Project Description**

# The students were tasked with constructing and analyzing diode-based circuits. The purpose of experiment is to expose the students to application of diodes and types of usage in circuits.

# **2.0 About Laboratory Day**

# The laboratory session took place on the Monday section between 6:00pm and 8:50pm on September 25, 2023. My lab partners were Nicolas and Brandon.

# **3.0 Computer Simulation (SPICE)**

# Pre-Laboratory Simulations

A) For the circuits of Fig. 1 and Fig. 2, choose available values of RL and C so that RLC = 0.2 second approximately. Draw the output waveforms when the input is sinusoidal of frequency 100 Hz and 10 V peak to peak, under the following cases:

1. Capacitor only is removed. Plot the transfer ( versus ) characteristics.
2. Resistor only is removed.
3. Capacitor and resistor are both in place. Calculate the peak-to-peak ripple voltage.

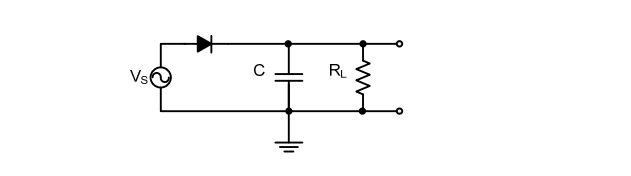


Figure 1

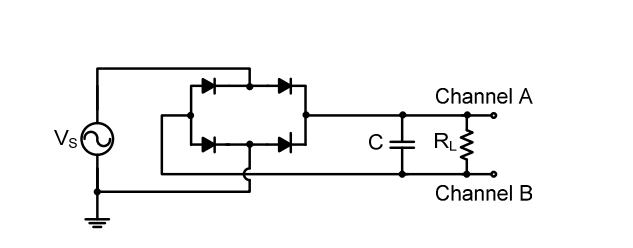


Figure 2

A screen shot of a graph

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Waveform without Capacitor

A screen shot of a graph

Description automatically generated

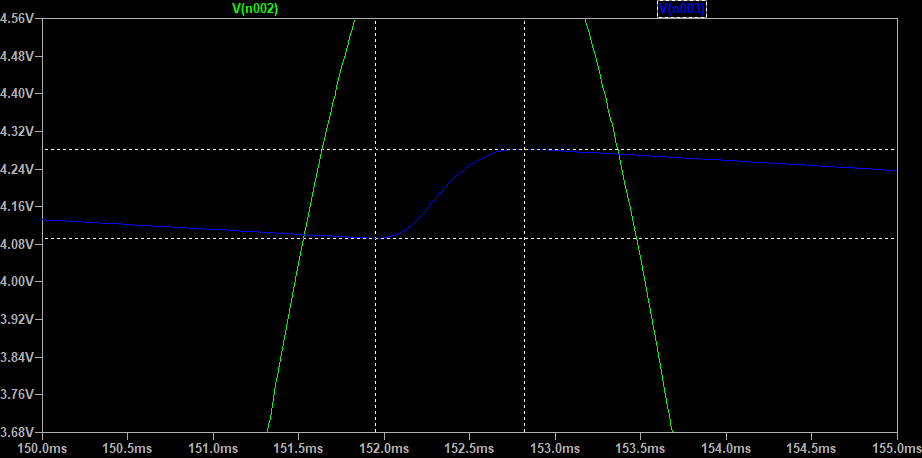
Waveform without Resistor

A screen shot of a graph

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Waveform with both Capacitor and Resistor

To compute the ripple voltage, we use the half-way rectifier equations, as shown below:

The simulated ripple voltage in LT-spice is .

A screenshot of a computer

Description automatically generated

The difference between the simulated value and the computed value is that the equation assumes that the diode has ideal behavior, however, in the simulation, LT-spice accounts for diode non-ideal parameters.

B) Determine the transfer characteristics of the circuits in Fig. 3 and Fig. 4. Draw the output waveforms assuming that the input is a sinusoid with sufficiently larger amplitude (larger than both reference voltages or the Zener voltages) amplitude.

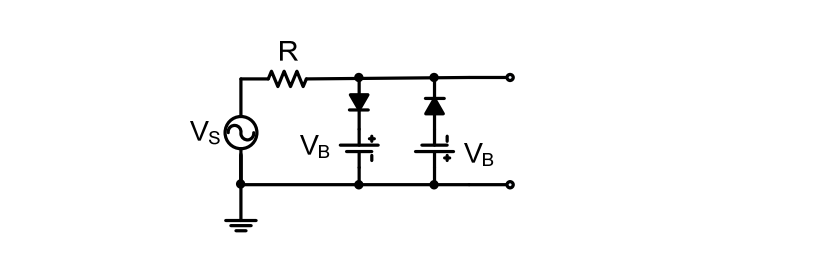


Figure 3

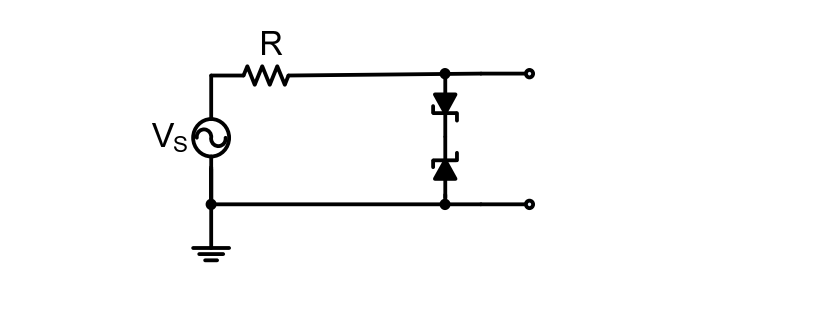


Figure 4

A screen shot of a graph

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Input vs Output Voltage for Fig. 3

For we used and the resistance value was .

A screen shot of a graph

Description automatically generated

Input vs Output Voltage for Fig. 4

The breakdown voltage for the Zener diodes in the simulation is which is similar to the diode used in the experiment.

C) For the circuit shown in Fig. 5, draw the output waveform if the input is a sinusoid. Do not neglect the diode turn on voltage (≈ 0.65 V). Select available values of R and C so that RC time constant is equal to 0.2 seconds approximately (e.g., for a capacitor of 10 µF, the resistor value should be 20 kΩ).

A diagram of a circuit

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Figure 5

A screen shot of a graph

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Input vs Output Voltage for Fig. 5

# **4.0 Experiment Procedure**

# **5.0 Observations and Simulation Comparison**

# **6.0 Learned Objectives**

* Use of function generator
* Measurement using oscilloscope and practical probing.
* Simulation via LT-spice
* Diode performances and diode IV curve
* Half-wave rectifier
* DC current measurement

# **7.0 Conclusion**