LAB REPORT FOR EXPERIMENT 4.2

Date: September 29th, 2021

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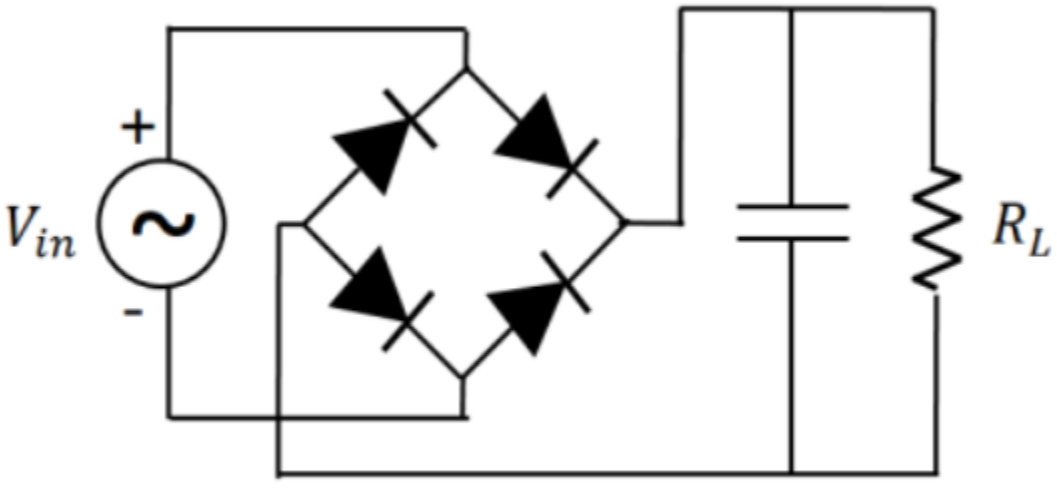
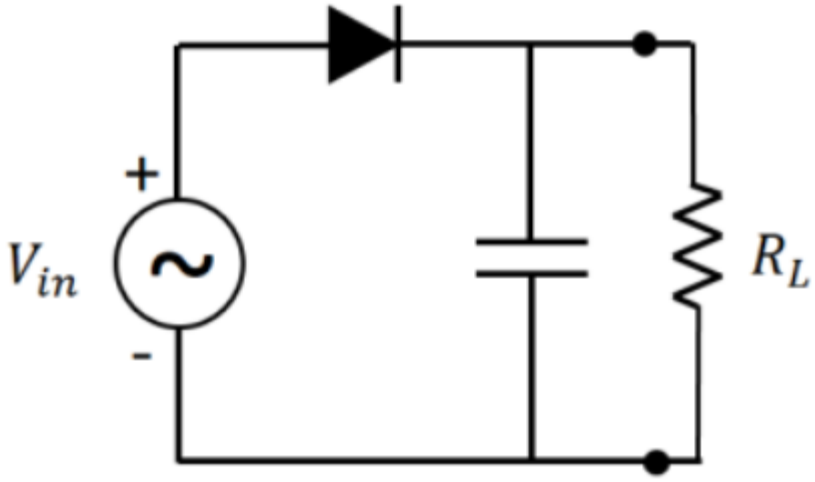
Experiment 4.2: Plot input and output voltage waveforms of a half-wave rectifier and full-wave rectifier circuit with and without capacitor [Diode(1N4148), R=1000 Ohm and C= 100u Farad]

Brief Description:

LTSpice was used for this experiment which is a software that simulates analog electronic circuits. We used a resistor of 1k Ohms with a voltage source in series with capacitor of capacitance-100 micro Farad and a silicon diode, 1N4148 (a standard silicon switching signal diode). Four cases were considered as shown in the subsequent pages of the report. Following is the schematic that was referred to:

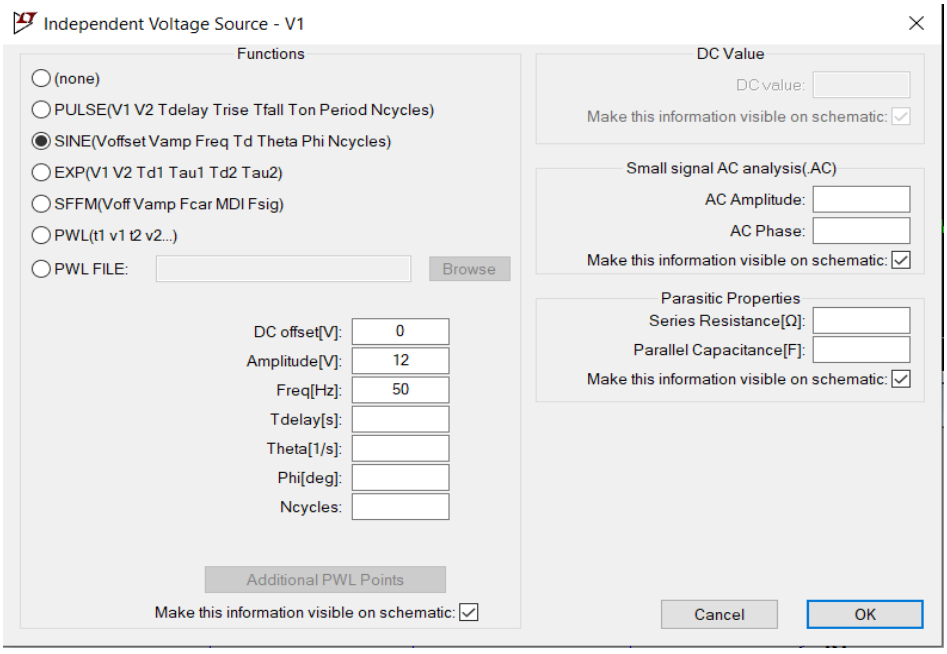


Full-Wave Rectifier



Half-Wave Rectifier

The parameters for the independent voltage source V1 are as follows :

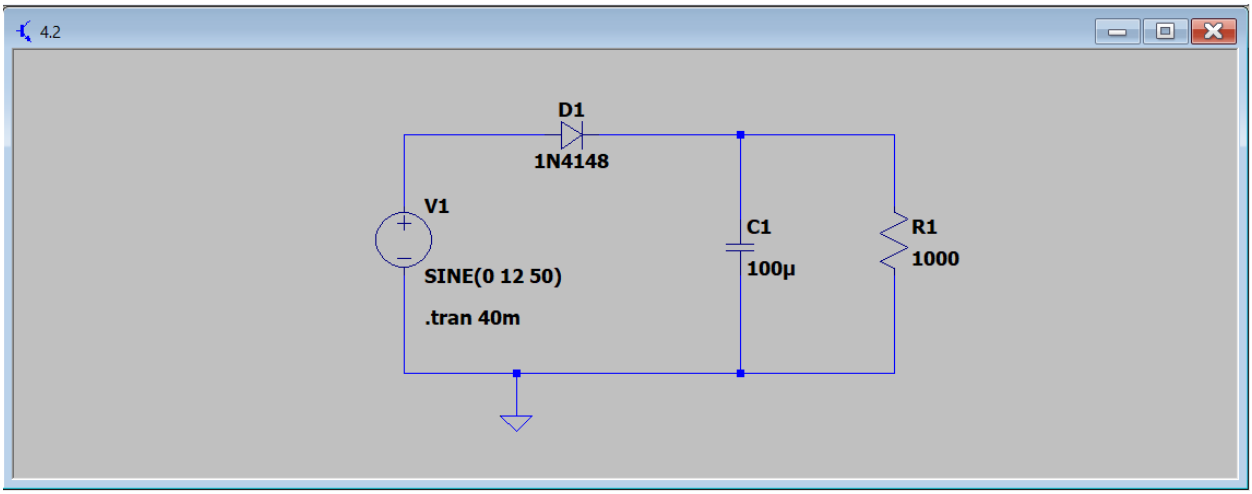


A graph to evaluate the output waveform with respect to frequency of the input signal was subsequently plotted.

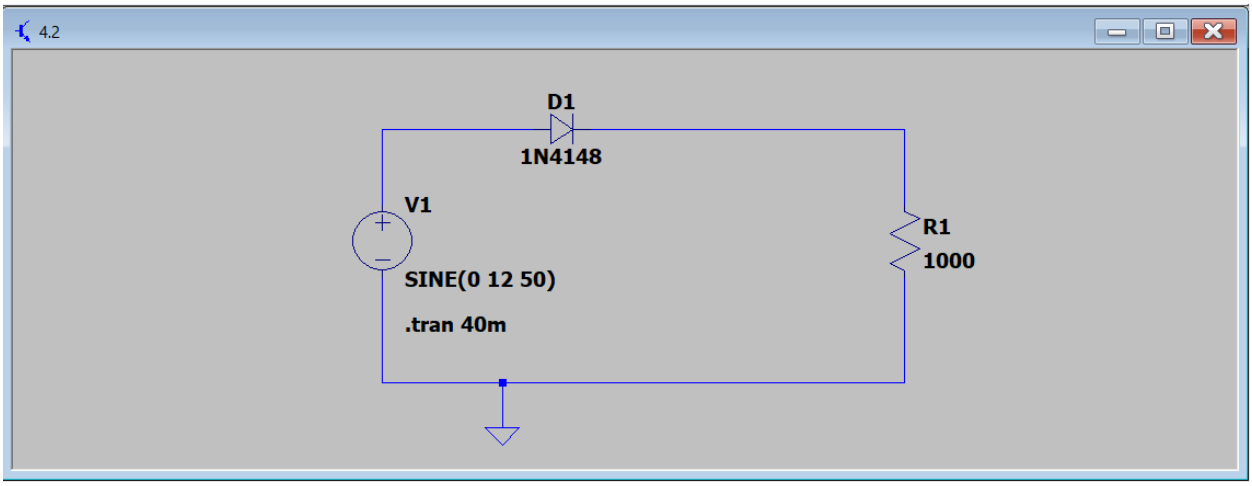
Schematic diagram:

The following is the layout of the circuit cases followed by the output waveforms

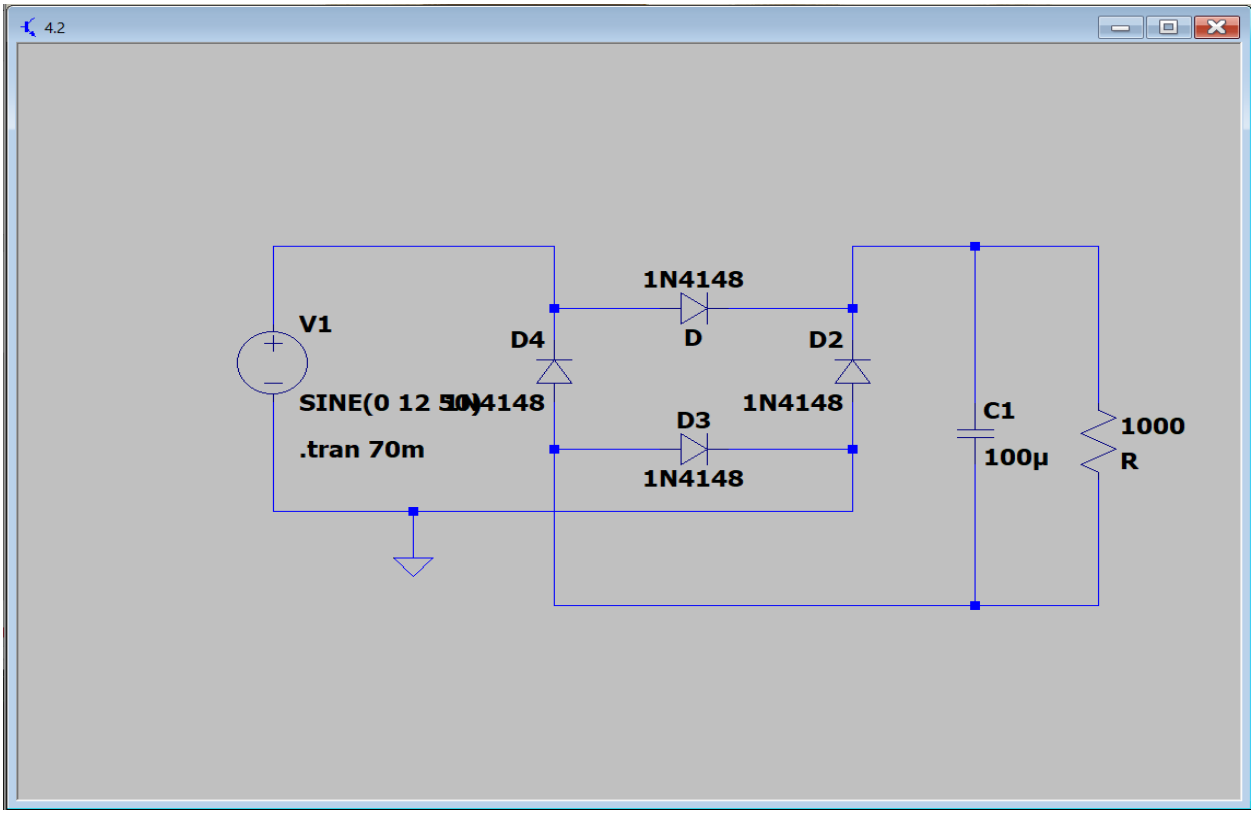
Case1: Half wave rectifier with capacitor



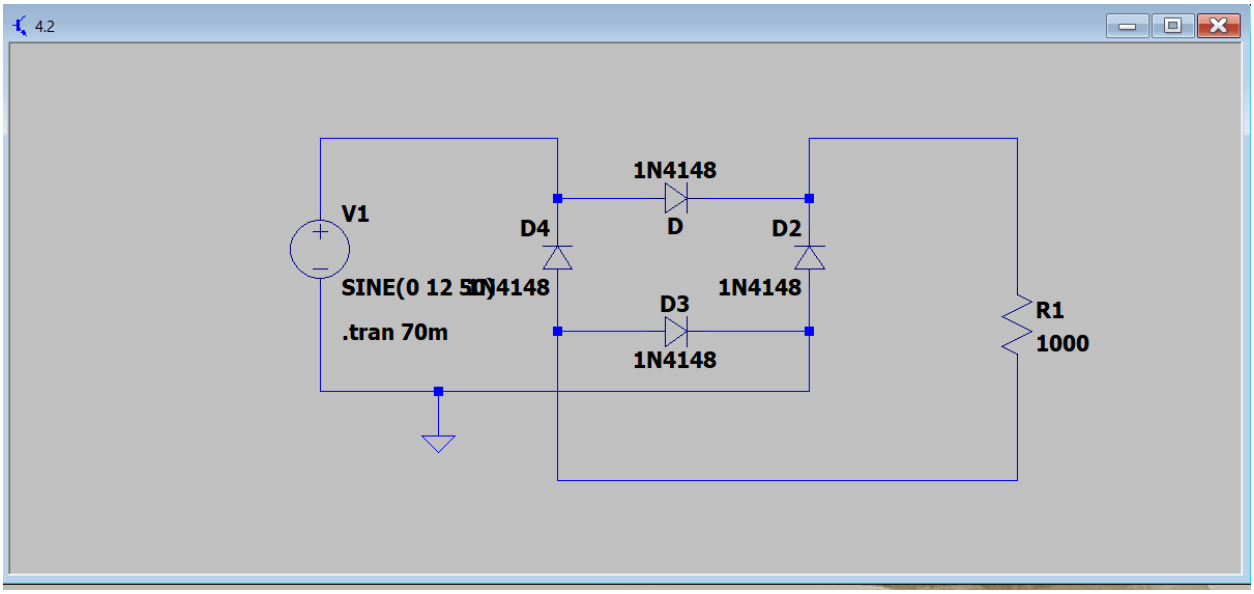
Case2: Half wave rectifier without capacitor



Case 3: Full wave rectifier with capacitor

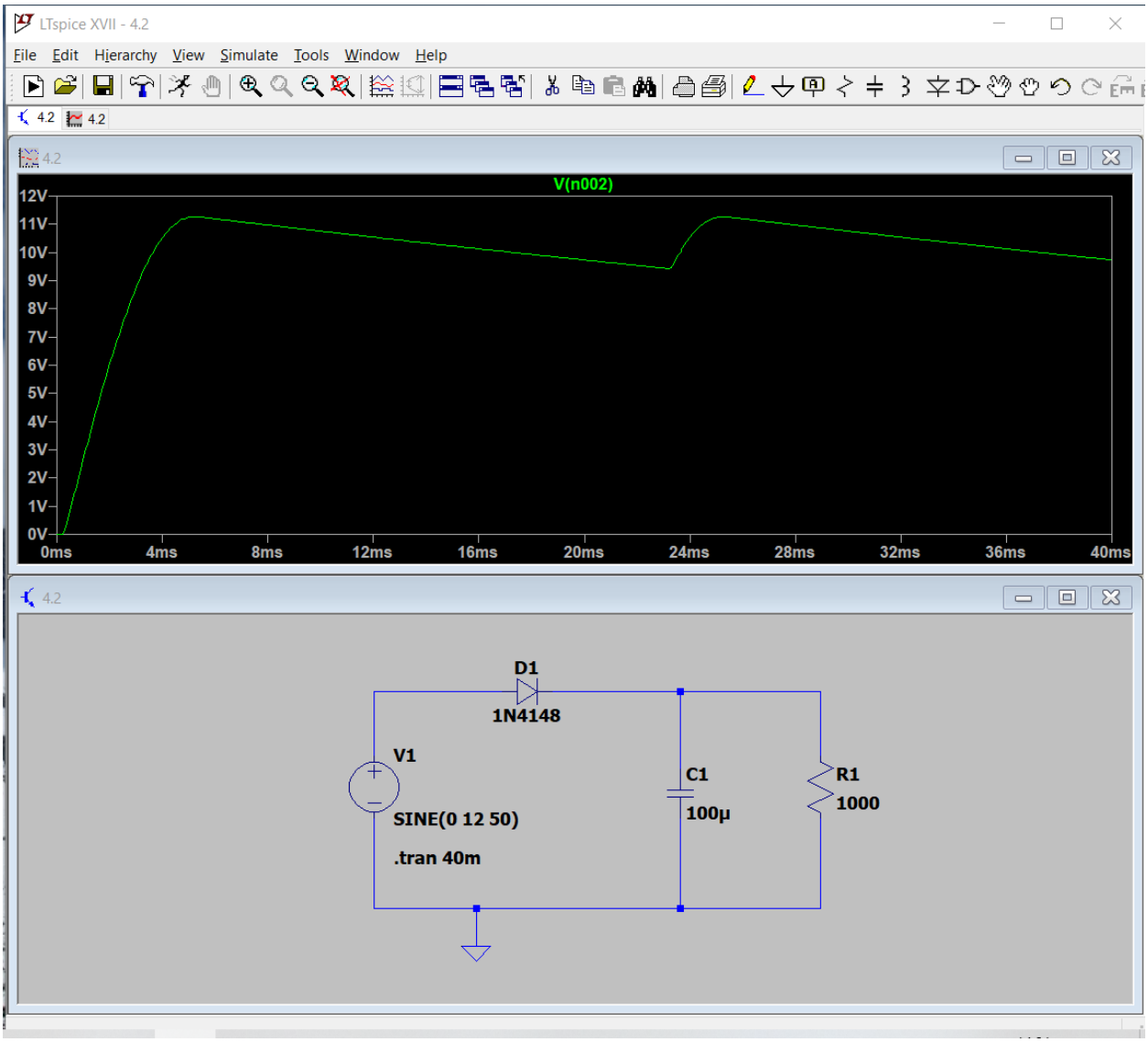


Case 4: Full wave rectifier without capacitor

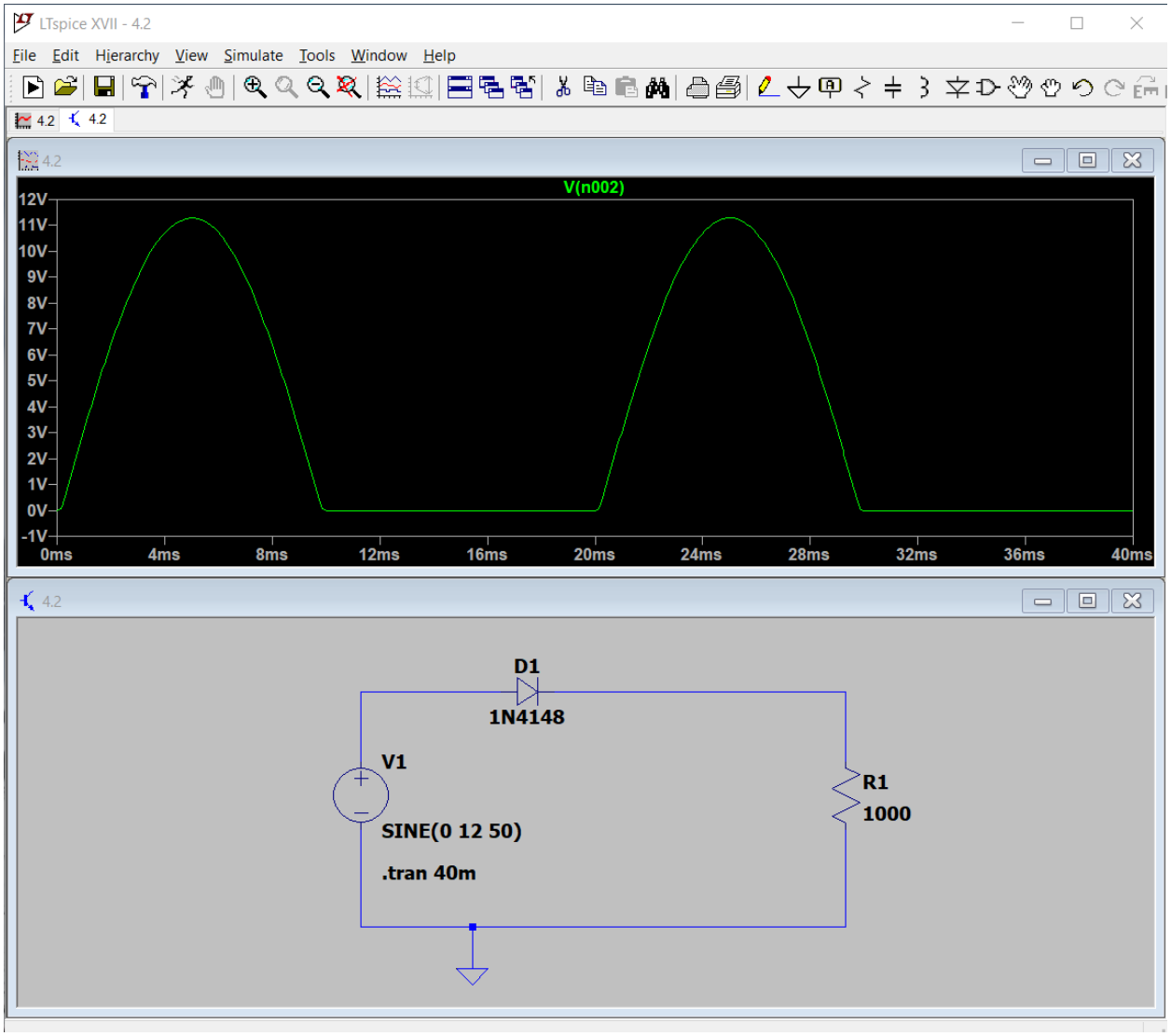


The corresponding waveforms for the cases are as follows :

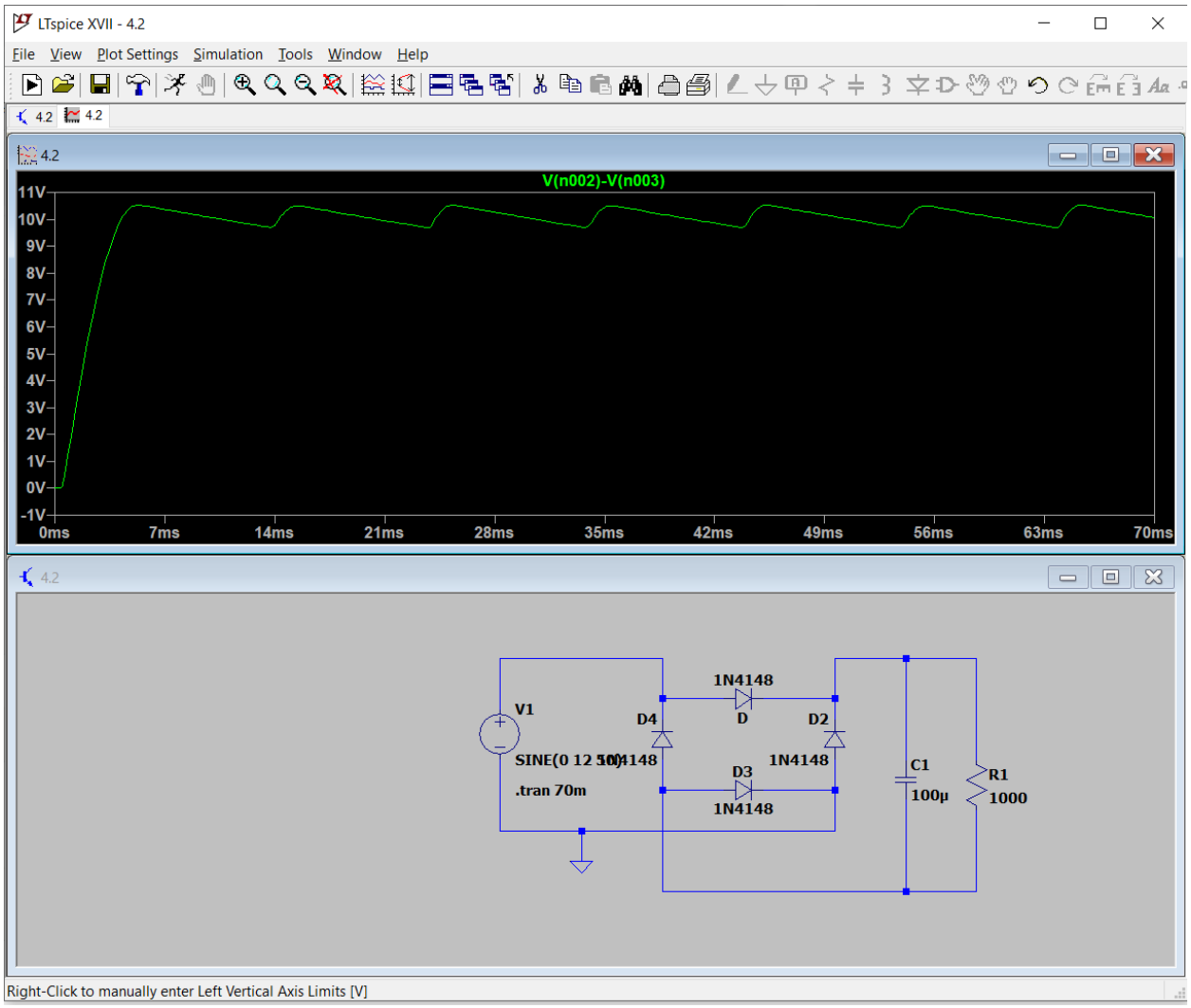
Half wave rectifier with capacitor



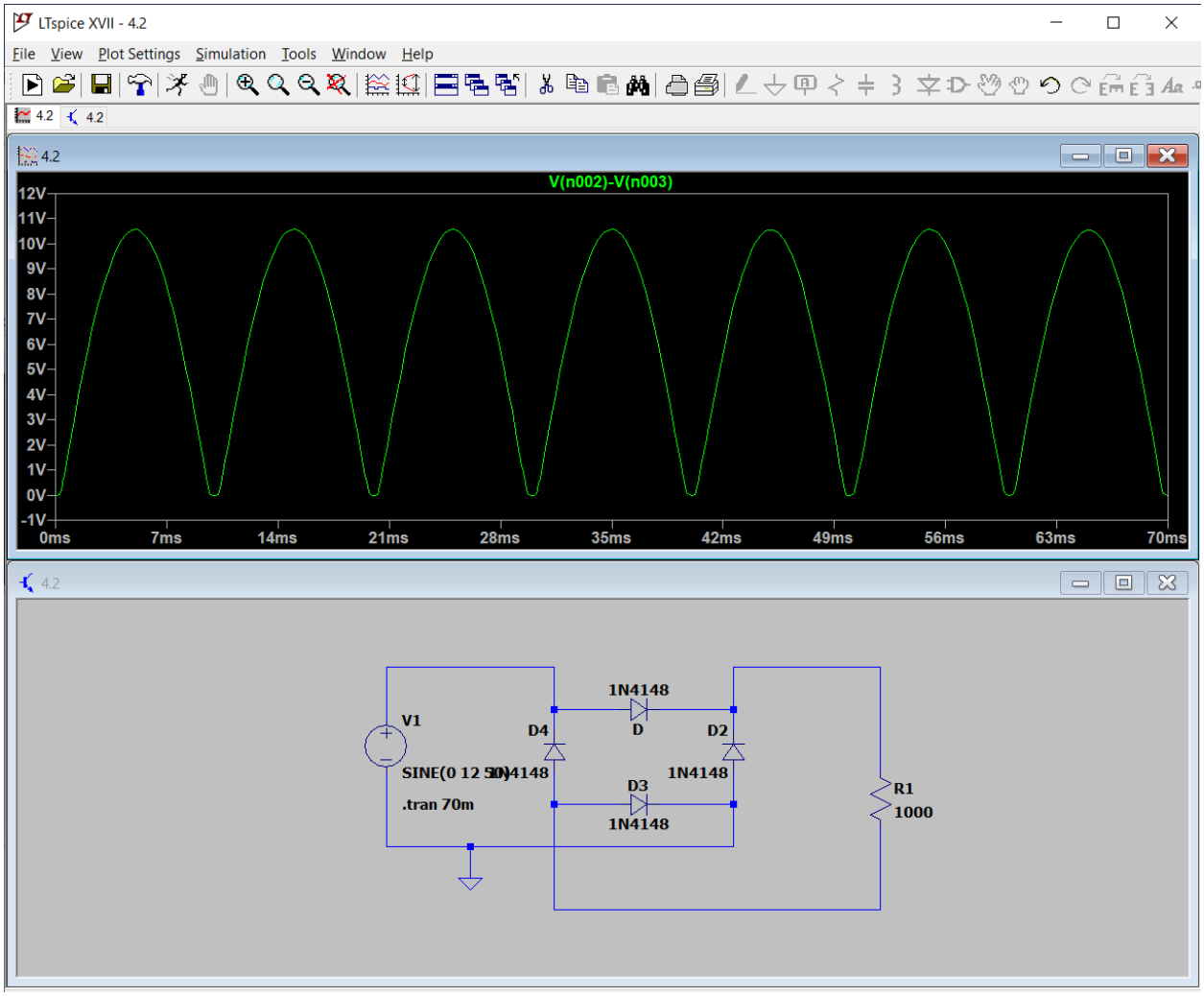
Half wave rectifier without capacitor



Full wave rectifier with capacitor



Full wave rectifier without capacitor



Discussion and Conclusion:

In the outputs of the transient simulation, we can observe that for the half-wave rectifier, the output consists of the sinusoidal parts of positive half-cycles without capacitance. On the contrary, when we use a capacitance in parallel, the output characteristics are a high pass filter in the time domain. For the full-wave rectifier, both positive and negative half-cycles are rectified without parallel capacitance. The output smooths out to almost linear characteristics for considerable time intervals when a parallel capacitance is used.

Rectifiers are the electrical circuits that convert the alternating currents (i.e. the currents that changes its direction with time) to a direct current (i.e. the current that has only one direction) by either removing a section of the signal with one polarity or converting the polarity of the signal to a single one. The most commonly used two types of rectifiers are half-wave and full-wave rectifiers. In the case of the half-wave rectifier, the diode conducts current only during the sinusoidal input's positive cycle and blocks the input's negative cycle. Hence, the output of the rectifier is only the positive cycle of the input signal. Thus, it is called a half-wave rectifier as it only rectifies the half part of the full signal. In the case of the full-wave rectifier, the 4 diodes are arranged so that during the positive cycle, two of the 4 diodes will conduct and during the negative cycle, the other two of the 4 diodes will conduct. In both cases, the current follows different paths and reflects as a positive signal at the output.