

SIMULATION HOMEWORK: DIODE APPLICATIONS

1. Give brief information about clipper and clamper circuits in your own words. Illustrate the circuits and explain how they work. Cite your sources.
2. Search definitions of SPICE diode model parameters, such as IS, RS, VJ, BV, and so on. Write these definitions in table format (one column for parameters, one column for definitions, and the other column for units if the parameter has one). Check your previous simulation homework. Are your comments correct about critical points on the diode characteristic curves such as junction potential and reverse breakdown voltage?
3. Setup the circuit given in Fig. 1 in OrCAD. Use 1N4001 diode model. Set frequency to 1kHz and plot the input and output voltages on the same plot pane for two time periods. Repeat the simulation for V1= 0 and V1=12V. Observe how the output changes. Explain how the circuit works.

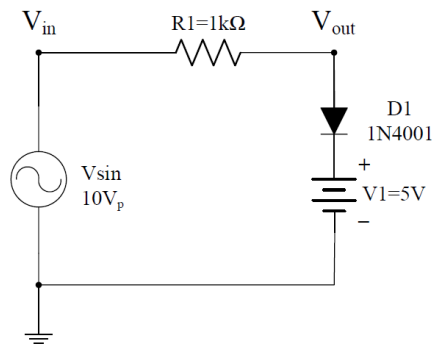


Figure 1

4. Setup the circuit given in Fig.2 in OrCAD. Use 1N4001 diode model. Set frequency to 1kHz and plot the input and output voltages on the same plot pane for two time periods. Repeat the simulation for V1= 0 and V1=12V. Observe how the output changes. Explain how the circuit works.

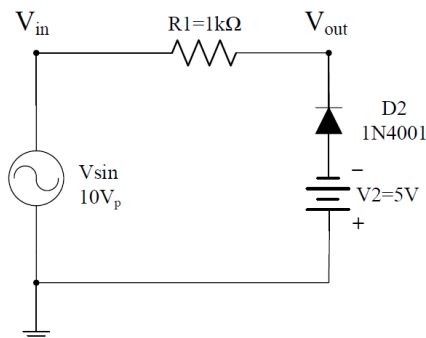


Figure 2

5. Setup the circuit in Fig. 3 in OrCAD. Simulate the circuit for the given voltages of V1 and V2. Set frequency to 1kHz and plot the input and output voltages on the same plot pane for two time periods. Explain how the circuit works.
 - a. $V_1=5V$ and $V_2=5V$
 - b. $V_1=2V$ and $V_2=5V$
 - c. $V_1=5V$ and $V_2=2V$

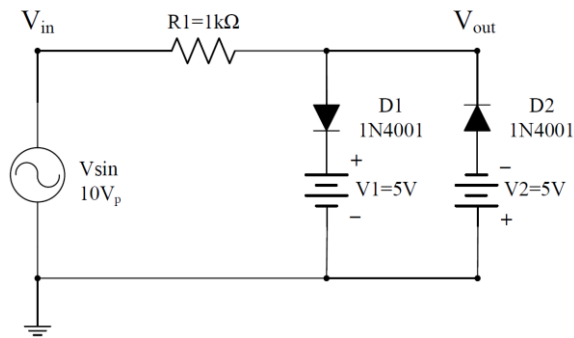


Figure 3

6. Setup the circuit in Fig. 4 in OrCAD. Set frequency to 1kHz and simulate the circuit. Plot the input and the output voltages on the same plot pane for two periods. Explain how the circuit works.

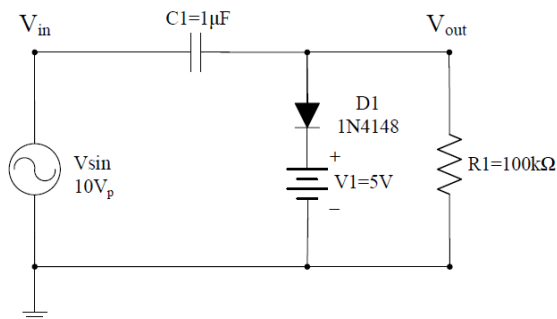


Figure 4

7. Setup the circuit in Fig. 5 in OrCAD (Only change the direction of D1 in Fig.4. Simulate the circuit and plot the input and the output voltages on the same plot pane for three periods. Explain how the circuit works.

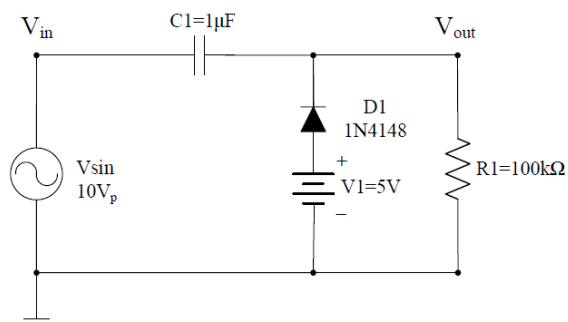


Figure 5

8. Build the one-way rectifier given in Fig. 6. Connect 6Vp (12Vp-p) sinusoidal input source with 1kHz frequency and use D1N4001 diode model.
- a. Analyze the circuit for each half-cycle of the input signal with and without capacitor. What are your expectations for the simulation?
- b. Choose $R1=10k\Omega$, $C1=0.1\mu F$. Firstly, observe the output signal when the capacitor is not connected. Then, observe it when the capacitor is connected. Give simulation results in your homework for each case.
- c. Simulate the same circuit when $R1=100k\Omega$ and $C1=100\mu F$.
- d. Comment on your simulation results in part (b) and part (c). Are your expectations satisfied?
- e. Plot the input and the output voltages on the same plot plane for five periods for the simulations.

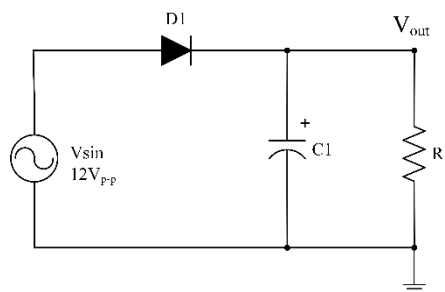


Figure 6

9. Build the bridge type rectifier given in Fig. 7. Connect 6Vp (12Vp-p) sinusoidal input source with 1kHz frequency and use D1N4001 diode model.
- a. Analyze the circuit for each half-cycle of the input signal with and without capacitor. What are your expectations for the simulation?
- b. Choose $R1=10k\Omega$, $C1=0.1\mu F$. Firstly, observe the output signal when the capacitor is not connected. Then, observe it when the capacitor is connected. Give simulation results in your homework for each case.
- c. Simulate the same circuit when $R1=100k\Omega$ and $C1=100\mu F$.
- d. Comment on your simulation results in part (b) and part (c). Are your expectations satisfied?
- e. Compare the rectifier circuits given in Fig. 6 and Fig. 7.

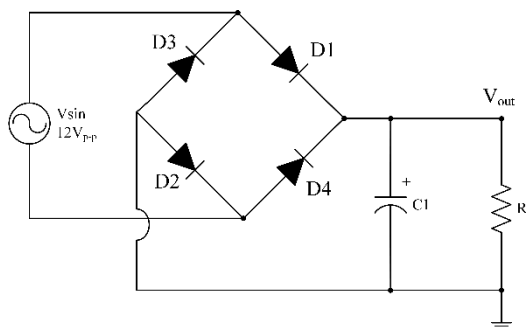


Figure 7

Note: Maximum step size should be 0.001 millisecond for all simulations.

