ee101_super_diode_1.sqproj

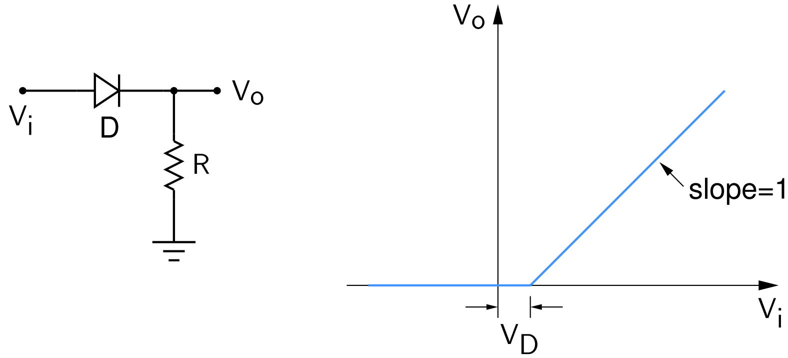

Figure 1: Half-wave rectifier circuit with a diode.

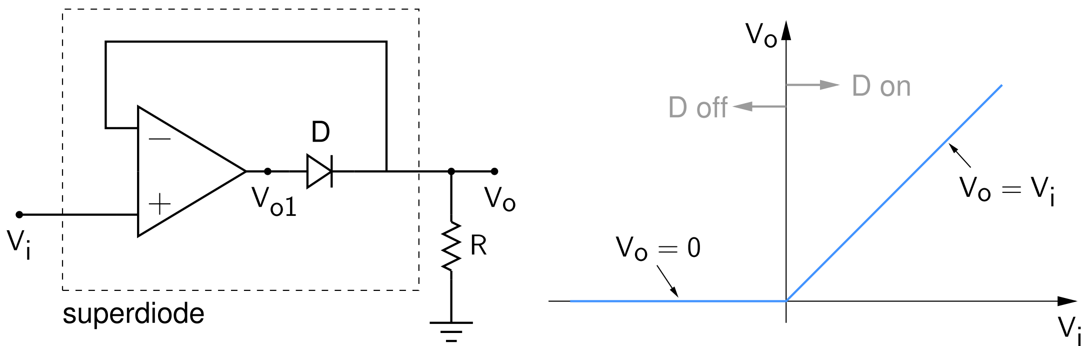

Figure 2: Half-wave rectifier circuit with a "super diode."

In the diode half-wave rectifier circuit shown in Fig. 1, the voltage drop across the diode (denoted by V_D in the figure, which is about 0.7 V for a silicon diode) is undesirable. Using a "super diode", i.e., a combination of an Op Amp and a normal diode, it is possible to get ideal half-wave rectifier behaviour, as shown in Fig. 2. It is the purpose of this simulation exercise to understand the super diode circuit.

Exercise Set

1. Simulate the circuit, and plot V_i and V_o (i.e., the voltages at nodes `a` and `out`, respectively) versus time for a low signal frequency of 50 Hz (the output of the first solve block in the circuit file). Observe the rectifying behaviour of the super diode.

2. Plot the voltage at the node `out1`. This is the Op Amp output voltage. Observe that the Op Amp goes into saturation part of the time. This makes the circuit response slow

since it takes some time for the Op Amp to get out of saturation. At a low signal frequency of 50 Hz, saturation is not a concern since the signal variation is slow enough for the circuit to follow the changes in the input.

3. Plot V_i and V_o versus time for a higher signal frequency of 1 kHz (the output of the second solve block in the circuit file). Observe that the output waveform is now different from the expected waveform because of the finite time required by the Op Amp to come out of saturation.

References

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3. A. S. Sedra, K. C. Smith, and A. .N. Chandorkar, *Microelectronic Circuits*, Oxford University Press, 2004.