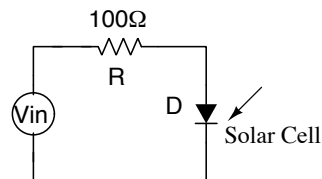


Simulation Exercise: Solar cell I/V characteristics and their dependence on series and shunt resistance

1. Download the model file for solar cell from the model file library. Read the model file. It describes the two diode model of solar cell.
2. Write the NGSPICE netlist to plot I/V characteristics for the same for following conditions with the input voltage varied from -2V to 2V. (You need to sweep the voltage V_{in} from -2V to 2V):



- (a) Dark (In the model file, set $I_L=0$)
- (b) Lighted characteristics for the intensities corresponding to light generated current $I_L = 8$ mA and 10 mA.
- (c) Obtain the values of ideality factor η , V_{oc} , I_{sc} , and fill factor in each case.

All you need to do is to modify your netlist in the previous experiment to suit the new model!

3. For $I_L=10$ mA,
 - (a) Plot I/V characteristics for series resistance $R_S = 0, 10$, and 30Ω . You may plot the part of characteristic in fourth quadrant, in the first quadrant for convenience if you should.
 - (b) Why is the part of the characteristic in the fourth quadrant important in solar cell characterization?
 - (c) How the I/V of solar cell is affected by the series resistance R_s ?
 - (d) Plot I/V characteristics for shunt resistance $R_{sh} = 100 \Omega, 500 \Omega$, and $5 \text{ K}\Omega$.
 - (e) What do you observe? What is effect of larger values of shunt resistance on the performance of the solar cell?

R_s and R_{sh} are the series and shunt resistances of the solar cell hence their values should be varied in the model file to observe the effect.