Birzeit University
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ENEE5102

"Measurement of Irradiance & PV Module I-V & P-V Characteristic Discussion"

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A PV module is commonly modelled using the single-diode model (SDM) , as shown in figure 1 which also includes the I-V and P-V characteristics of a typical module .

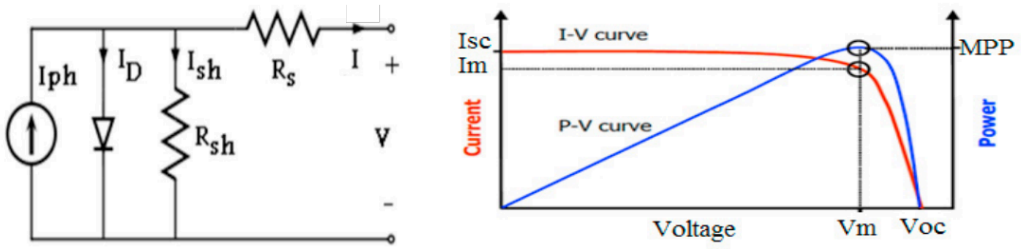

Figure 1

The equation representing this model is transcendental and implicit in nature and its solution normally involves considerable computational complexity and may require significant amount of simplifications and approximations. The problem of modeling a PV system is further compounded by the fact that the I-V characteristic of a PV module is dependent on insolation, which is continuously changing A Datasheet of a PV module normally provides module's specifications only at standard test conditions (STC). Consequently, the extraction of parameters required to model a PV module/array are extracted at STC and subsequently, these parameters must be adjusted according to the prevailing irradiance. The objective of this experiment is to provide a comparison between various situation to study the performance of pv cells.

Consider, for the moment, a single PV module that you want to connect to some sort of a load ؛The load might be a dc motor driving a pump or it might be a battery, for example. Before the load is connected, the module sitting in the sun will produce an open-circuit voltage VOC, but no current will flow. If the terminals of the module are shorted together (which doesn't hurt the module at all, by the way), the short-circuit current ISC will flow, but the output voltage will be zero. In both cases, since power is the product of current and voltage, no power is delivered by the module and no power is received by the load. When the load is actually connected, some combination of current and voltage will result and power will be delivered. To figure out how

much power, we have to consider the I –V characteristic curve of the module as well as the I –V characteristic curve of the load.

At the two ends of the I –V curve, the output power is zero since either current or voltage is zero at those points. The maximum power point (MPP) is that spot near the knee of the I –V curve at which the product of current and voltage reaches its maximum.

We noticed as insolation drops, short-circuit current drops in direct proportion. Cutting insolation in half, for example, drops ISC by half. Decreasing insolation also reduces VOC, but it does so following a logarithmic relationship that results in relatively modest changes in VOC.

Modules can be wired in series to increase voltage, and in parallel to increase current. Arrays are made up of some combination of series and parallel modules to increase power. For modules in series, the I –V curves are simply added along the voltage axis. That is, at any given current (which flows through each of the modules), the total voltage is just the sum of the individual module voltages.

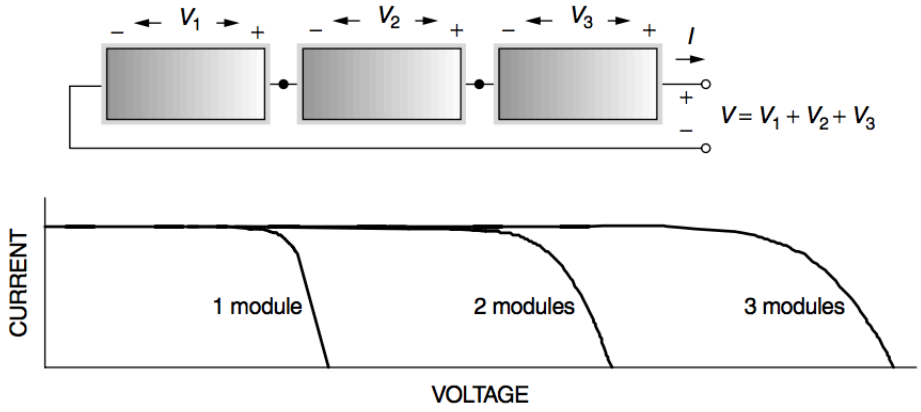

Figure 2

For modules in parallel, the same voltage is across each module and the total current is the sum of the currents. That is, at any given voltage, the I –V curve of the parallel combination is just the sum of the individual module currents at that voltage

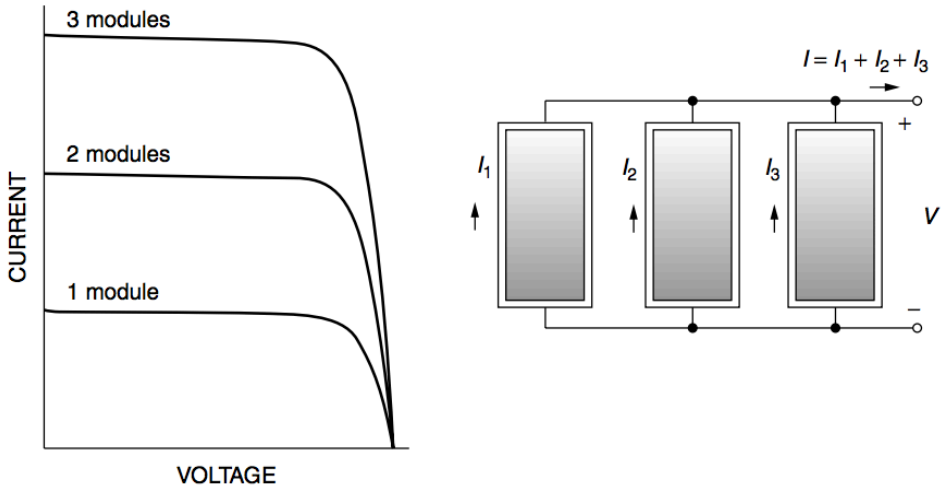

Figure 3

When high power is needed, the array will usually consist of a combination of series and parallel modules for which the total I –V curve is the sum of the individual module I –V curves. There are two ways to imagine wiring a series/parallel combination of modules: The series modules may be wired as strings, and the strings wired in parallel.