# LAB # 03

## Analyzing PV Array Set With Load and Vary Irradiance

### **Objective:**

- To understand the PV array characteristics with resistive load
- To analyze and observe the characteristics of PV array by varying the irradiance
- To observe and calculate the output voltage & current of resistive load

#### **Component required**:

- PV array
- Stair generator
- Voltage measurements
- Current measurements
- Series RLC branch
- Scope
- Bus selector
- Powergui

### **Circuit diagram:**



### Simulink Block Diagram of PV Array With Resistive Load

## **Description:**

#### Stair generator:

Stair generator used to provide the value of irradiance & temperature to PV array.

In case of irradiance, we set the value of time is [0, 3, 7,10], amplitude is [500, 1000, 1000, 500] and the sampling time is 0.1.

In case of temperature, we set the value of time is [0, 1, 3], amplitude is [25, 25, 25] & sampling time 0.1.

#### **PV array:**

#### **Pin description:**

- Input 1 = Sun irradiance, in  $\frac{kW}{m^2}$
- Input 2 = Cell temperature, in deg. C

#### **Outputs:**

- +, (dc supply)
- pin (m) shows the properties/parameters of module.

The input irradiance & temp. is connected to stair generator, whose characteristics are defined above.  $\mathbf{m}$  terminal of PV array connected with bus bar.

#### **Block Parameters of PV Array:**

Block Parameters: PV Array		
PV array (mask) (link)		
Implements a PV array built of strings of PV modules connected in parallel. Each string consists of modules connected in series. Allows modeling of a variety of preset PV modules available from NREL System Advisor Model (Jan. 2014) as well as user-defined PV module Input 1 = Sun irradiance, in W/m2, and input 2 = Cell temperature, in deg.C.		
Parameters Advanced		
Array data		Display I-V and P-V characteristics of
Parallel strings		array @ 1000 W/m2 & specified temperatures 🔹
4 Series-connected modules per string		T_cell (deg. C) [ 45 25 ]
10		Plot
Module data		Model parameters
Module: 1Soltech 1STH-215-P		Light-generated current IL (A)
Plot I-V and P-V characteristics when a module is selected		7.8649
Maximum Power (W)	Cells per module (Ncell)	Diode saturation current I0 (A)
213.15	60	2.9259e-10
Open circuit voltage Voc (V)	Short-circuit current Isc (A)	Diode ideality factor
36.3	7.84	0.98117
Voltage at maximum power point Vmp (V)	Current at maximum power point Imp (A)	Shunt resistance Rsh (ohms)
29	7.35	313.3991
Temperature coefficient of Voc (%/deg.C)	Temperature coefficient of Isc (%/deg.C)	Series resistance Rs (ohms)
		OK Cancel Help Apply

#### Bus bar & scope:

Bus bar is used to connect the **m** terminal of PV array with scope with the help of scope. We observe the following characteristics of PV array

- V\_PV
- I\_PV
- I\_diode
- Irradiance
- Temperature

#### **Current & voltage measurements:**

By using voltage & current measurements blocks, we observe the output voltage & current of Resistive load connected with PV array with the help of scope.

#### **Resistive load:**

We use series RLC branch as a load. Set the type of branch is resistive & set the value of resistor. **Powergui:** 

The powergui block allows you to choose one of these methods to solve your circuit:

- Continuous, which uses a variable-step solver from Simulink.
- Ideal switching continuous.
- Discretization of the electrical system for a solution at fixed time steps.
- Phasor solution.

Set simulation type is discrete.

#### **Output waveforms:**

#### **Output Voltage & Current Waveforms of Resistive Load:**

## **Output Characteristics Waveforms of PV array:**

## **Conclusion and Comments:**