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Simulation and Study of Effects of Photovoltaic System under Partially Shaded Conditions

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Abstract

This paper represents the comparison between PV panel characteristics obtained under nominal test conditions and characteristics obtained during somewhat shaded circumstances. Moreover, the effects about PSC of PV panel on peak voltage and peak power are studied. The software used to study the effects is the Matlab/Simulink model. The performance parameters of the PV panel are also studied. In this paper, PV panel under PSC using a bypass diode. a model-based study is presented. In a solar PV arrangement, it is likely that partial darkness may drop over. During PSC, the PV characteristic gets added difficult with multiple peaks. PV arrangement system consists of 60 cells in sequence with to show 2 situation, However one with is no PS and one involved PS. During shading and un-shading condition, the characteristics is compared and shown in this paper. The results are shown with descriptive forms to show the results.

Keywords: *Big Data Security, Hadoop Security, Homomorphic Encryption*

I. INTRODUCTION

Photovoltaic systems are one among the popular source for energy generation and widely used in various power applications such as grid integration, stand-alone applications and battery integration. Thus, the net power transferred to the load must be inspected by considering different factors such as partial shading, cell temperature, moisture, wind speed and dirt particles in the atmosphere. In this paper, PS of PV panel is considered for investigation scheme. The main motive of the paper is to study the effects of partial shading on PV panel characteristics. The analysis and study of PS condition of PV panel is simulated using Matlab/Simulink model and its output performance parameters are calculated. Primarily, the I-V and P-V characetristics of PV panel are studied under Standard Test Conditions(STC) and Partial Shading Conditions(PSC) and their results are compared. A 250 W, 31 V PV panel is considered for analysis.

Photovoltaic cell harnesses the solar power form our sun, which are really packets of photons. This energy was in fact not used until centenary. But now our addiction on electricity had influenced to a level of premier need for our life and also we had been penetrating for the options available for non-sustainable energy resources, our zeal for fresh, enhanced and affluent was fulfilled by wealth of solar force. So field of solar power is very vital and had a lot of opportunity in upcoming existence. [1]

In a PV array PV modules are linked in series and parallel to obtain the essential amount of power. The entire power in such a PV array is, Slighter than the summation of the rated power of every unit component. The paper covers one of the core-reason for this differentiation in power i.e. PS. Entire cells in a series circuit array are compelled to take the same current as well as those with PS. The shaded cells might become reverse biased and may perform as loads, and run out power from totally lighted up cells. If this arrangement is not correctly sheltered, problems like hot spot possibly will take place and the arrangement may be irreversibly spoilt in several cases.

PV panels are build in the present day in a permanent series-parallel pattern and the sole module is geared up with bypass diodes with integrated indifferent combinations. The function of this diode is to keep away from the sole module when it is considerably radiated in order to keep them away from single module current may shrink the current of the complete PV array. The aim of this paper, to demonstrate the property of PS on PV array characteristics .This is prepared by simulation using Matlab/Simulink.

II. PV Panel Description

A PV cell is a DC power generating source based on the temperature and intensity incident sunlight. The incident photons over the surface of the silicon layer injects electrons to move towards the anode region externally via conductors. This transfer of light energy to electrical energy is called photovoltaic effect. The output current of a PV cell can be written as,

$$I = I_{pv} - I_0\left[e^{\frac{U+IRs}{nVT}} - 1\right] - \frac{U+IR_s}{R_{sh}} \quad (1)$$

Where,

Ipv is generated source current
Io is diode reverse saturation current
U is output PV voltage
R_s and R_{sh} are resistance of series and shunt
n is diode ideality factor
Vt is thermal volatge
I is PV output current.

The equivalent cicrcuit of a PV cell is shown in Figure 1 and I-V, P-V character is shown in Figure 2.

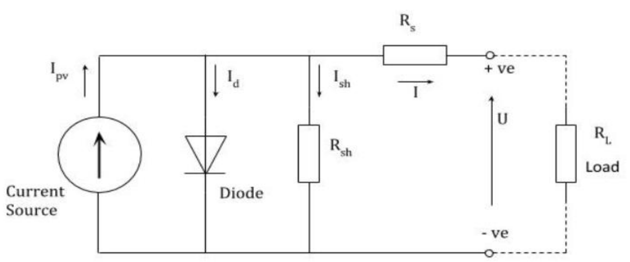

Figure 1. Equivalent circuit of PV cell

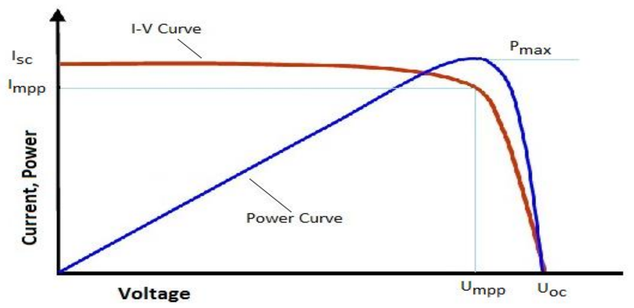

Figure 2. I-V and P-V character of a typical PV cell

The design specifications of PV 250 W, 31 V, PV panel is shown in Table 1.

Table 1. Design specifications of PV panel

Parameters	***Values***
Peak Power, Pmpp	*250 W*
Peak voltage, Vmpp	*37.92 V*
No. of cells, N	*60*
No. of series and parallel strings	*3,1*

III. PV charactersitics under STC

The standard test conditions are defined to be 1000 W/m2 insolation at 25 degree C cell temperature. Under standard test conditions, the circuit model of PV system is simulated and its characteristics are obtained. The responses are plotted as shown in Figures 2 and 3 respectively.

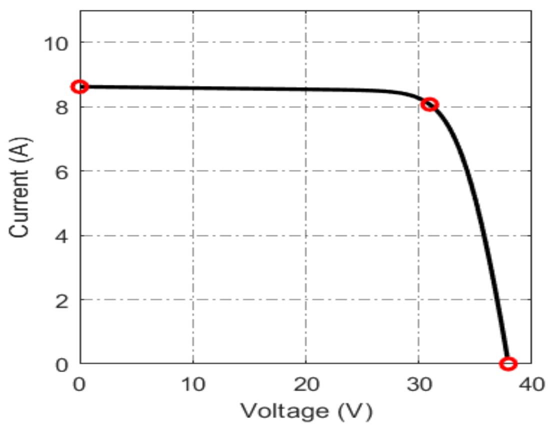

Figure 2. I-V character of PV panel under STC

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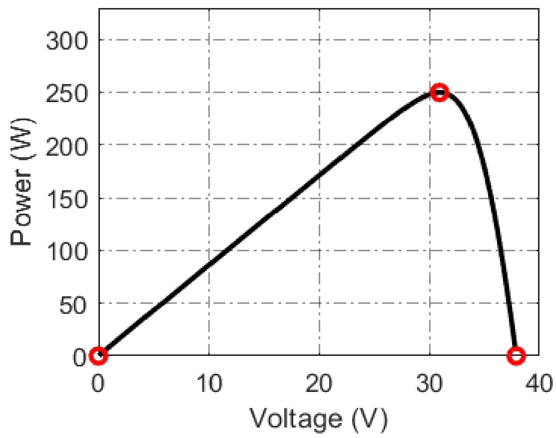

Figure 3. P-V character of PV panel under STC

IV. PV charactersitics under PSC

Partial shaded condition is defined as the exposure of PV cells to partial insolation unlike insolation at STC. Under PSC, the cell numbers 1-20, 21-40 and 41-60 are exposed to 1000 W/m2, 300 W/m2 and 600 W/m2 insolation respectively. The circuit model of the system is shown in Figure 4.

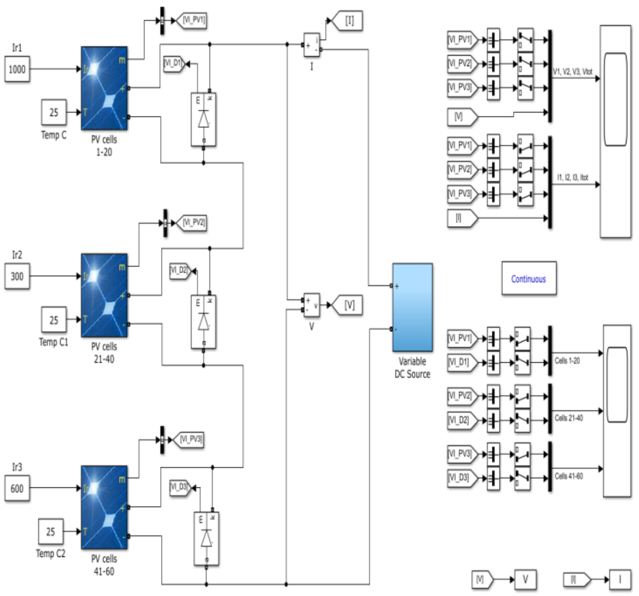

Figure 4. Simulink model of the PV panel

Under partial shaded conditions, the circuit model of PV system is simulated and its characteristics are obtained. The responses are plotted as shown in Figures 4 and 5 respectively.

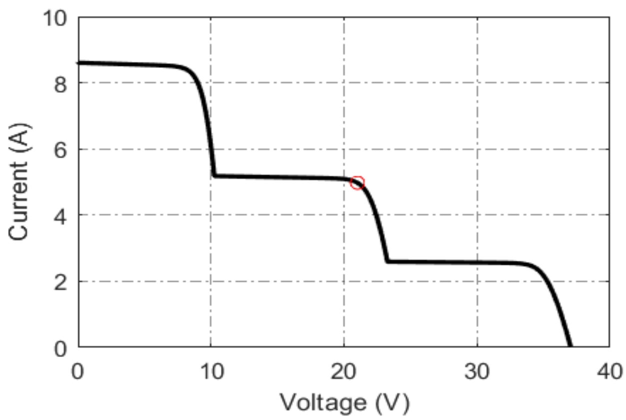

Figure 5. I-V Characteristics of PV panel under PSC

The peak power and voltage observed from the plots are 110 W and 22 V respectively.

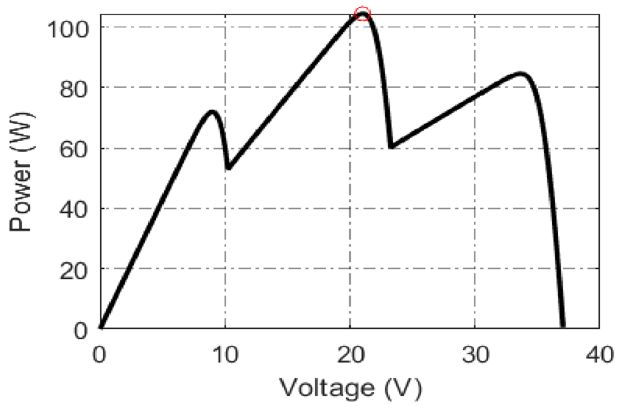

Figure 6. P-V Characteristics of PV panel under PSC

V. CONCLUSION

The I-V and P-Vcharacteristics of PVpanel under STC and PSC are obtained by simulating its corresponding circuit model using Matlab/simulink software. On Comparing, the peak power obtained under PSC is about one – half of the peak power obtained under STC. Thus, the effects of partial shading on Vmpp and Pmpp are studied using Matlab.

Under partial shaded conditions, the circuit model of PV system is simulated and its characteristics are obtained. The responses are plotted as shown in Figures 4 and 5 respectively.

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REFERENCES

[1] Partial Shading of PV System Simulation with Experimental Results-Basim A. Alsayid, Samer Y. Alsadi, Jafar S. Jallad, Muhammad H. Dradi

[2] Simscape Model of PV Cell- G.Venkateswarlu1, Dr. P. Sangameswar Raju

[3] Simscape Solar Cells Model Analysis and Design- MOHAMMED S. IBBINI, SHADI MANSI, MOHAMMED MASADEH, EID AL HAJRI

[4] On the Impact of Partial Shading on PV Output Power- DEZSO SERA, YAHIA BAGHZOUZ

[5] Hiren Patel and Vivek Agarwal, "MATLAB-Based Modeling to Study the Effects of PS on PV Array Characteristics", IEEE TRANSACTIONS ON ENERGY CONVERSION, VOL 23, NO 1, MARCH 2008.

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