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**ABSTRACT-**

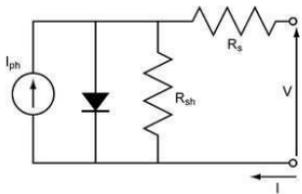
The output characteristics of Photovoltaic array is nonlinear and is influenced by solar irradiation level, ambient temperature, wind speed, humidity, pressure etc. A major challenge in using a PV source is to tackle its nonlinear output characteristics, which vary with temperature and solar irradiation. The characteristics get more complicated if the entire array does not receive uniform solar irradiation, as in partially shaded conditions, due to passing by clouds, neighboring buildings, towers, trees and telephone poles, resulting in multiple peaks in the P-V characteristics. The presence of multiple peaks reduces the effectiveness of the existing maximum power point tracking (MPPT) schemes, due to the inability to effectively discriminate between the local and global maxima in the P-V characteristics. It is pertinent to track and find the optimal operating voltage of PV arrays in order to increase the efficiency of PV generators.

**KEY WORDS-** MPPT, Photovoltaic (PV) cell, Matlab simulation

**1. INTRODUCTION**

**MPPT or Maximum Power Point Tracking** is algorithm that included in charge controllers used for extracting maximum available power from PV module under certain conditions. The voltage at which PV module can produce maximum power is called 'maximum power point' (or peak power voltage). Maximum power varies with solar radiation, ambient temperature and **solar cell** temperature. It is desirable to achieve Maximum Power Point output at minimum cost under various operating conditions. However, the Maximum Power Point varies with solar insolation. It is difficult to achieve an optimum matching that is valid for all insolation levels.

**II. THE MODEL OF A PV CELL**



**Fig.1 Equivalent circuit of solar cell model**

The output current  $I$  is:

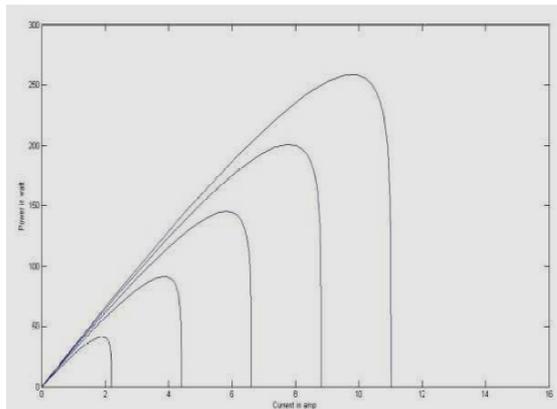
$$I = I_{ph} - I_s[\exp(V + IR_s / NV_t) - 1] - V + IR_s / R_{sh}$$

$$I_{ph} = I_{ph0}r / I_{r0}$$

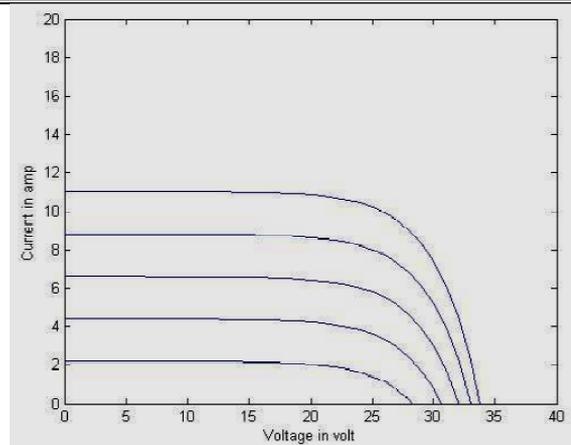
$$V_t = KT / q$$

**III. SIMULATION OF PV CELLS**

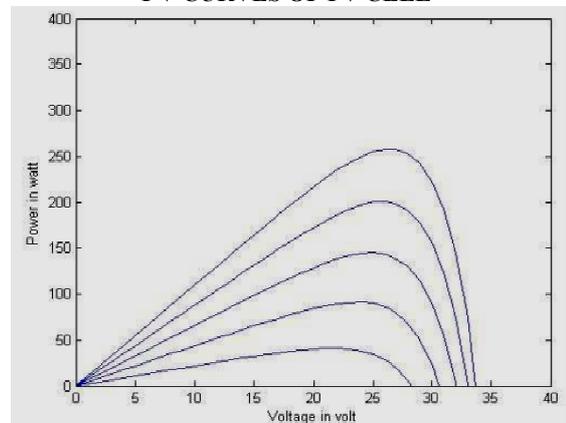
On account of mathematical model of PV cell Matlab simulation the output characteristics of PV cells. The output characteristic of Photovoltaic array is nonlinear and is influenced by solar irradiation level, ambient temperature, wind speed, humidity, pressure etc.



**P-I CURVES OF PV CELL**



**I-V CURVES OF PV CELL**



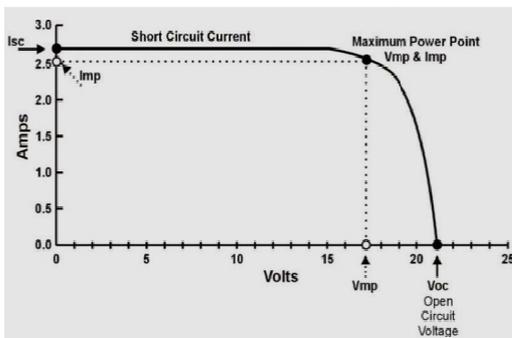
**P-V CURVES OF PV CELL**

**IV MAXIMUM POWER POINT**

The major principle of MPPT is to extract the maximum available power from PV module by making them operate at the most efficient voltage (maximum power point). That is to say: MPPT checks output of PV module, compares it to battery voltage then fixes what is the best power that PV module can produce to charge the battery and converts it to the best voltage to get maximum current into battery. It can also supply power to a DC load, which is connected directly to the battery.

MPPT is most effective under these conditions:

- Cold weather, cloudy or hazy days: Normally, PV module works better at cold temperatures and MPPT is utilized to extract maximum power available from them.
- When battery is deeply discharged: MPPT can extract more current and charge the battery if the state of charge in the battery is lowers.



## CHARACTERISTIC OF SOLAR CELL

### V. MPPT techniques

Many MPPT techniques can be divided into following ways:

- (1) Perturb and Observe method (P&O) "Hill climbing method"
- (2) Constant Voltage Tracking and "Look up table" method.
- (3) Increase Conduction (IncCond) method.

These algorithms each has his relative merits and can be used in different fields. The P&O and IncCond algorithms are the most widely adopted among these MPPT algorithms due to the high tracking accuracy at steady state.

#### (1) Perturb and observe

Perturb and observe (P&O) is a widely used technique because of it being intuitive and easy to implement. The fundamental P&O method concerns measuring voltage and current from the solar panel while perturbing the operating voltage and comparing the power received at the new voltage with the power received at the old voltage. If higher power was measured at the new voltage the next perturbation will be in the same direction as the last, it will otherwise go in the opposite direction. This technique employs a fixed step size, and choosing this size will lead to a trade off between convergence speed and oscillation size. If using large steps in the perturbations, the convergence to the MPP will be fast, but the system will oscillate around the MPP, smaller steps will result in slower convergence and smaller oscillations.

If using a power converter, changing of the operating voltage is done indirectly by changing the duty cycle of the power converter which will affect the amount of current drawn from the panel, when the P&O method is applied to such a setup it is called hill-climbing

#### (2) Increase Conduction (IncCond) method

Incremental conductance uses the fact that the power derivative with respect to voltage will be equal to zero at the MPP and positive for voltages below the MPP as well as negative for voltages above the MPP

## VI CONCLUSION

This paper establishes a kind of PV model based on physical and mathematical models of photovoltaic array in application of Matlab/Simulink Model for simulation of a solar cell has been developed in simelectronics (Matlab simulink). The output characteristics of a PV array are influenced by the environmental factors, and the conversion efficiency of PV array is very low. So real time simulation of PV array is very important to the research of PV Grid connected system. Photovoltaic array simulation can be used to find better methods to implement maximum power point tracking (MPPT) control for efficient solar power systems.

The characteristics of photovoltaic arrays based on Matlab simulation are also analyzed and the methods for maximum power point are also represented for tracking the maximum point for maximum output from solar cell.

### Some fundamental facts about solar cells:

- Short circuit current:  $I_{sh} = I_{ph}$ . It is the greatest value of the current generated by a cell. It is produce by the short circuit conditions:  $V = 0$ .
- Open circuit voltage correspond to the voltage drop across the diode (p-n junction), when it is transverse by the photocurrent  $I_{ph}$  (namely  $IL = I_{ph}$ ), namely when the generated currents is  $I = 0$ .
- Maximum power point is the operating point  $A(V_{max}, I_{max})$  at which the power dissipated in the resistive load is maximum:  
 $P_{max} = V_{max}I_{max}$ .
- Maximum efficiency is the ratio between the maximum power and the incident light power.  
 $\eta = P_{max} / P_{in} = I_{max}V_{max} / AGa$   
Where  $G_a$  is the ambient irradiation and  $A$  is the cell area.
- Fill factor is the ratio of the maximum power that can be delivered to the load and he product of  $I_{sc}$  and  $VOC$ :

$$FF = P_{max} / VocI_{sc} = I_{max}V_{max} / VocI_{sc}$$

The fill factor is a measure of the real  $I-V$  characteristic. Its valued is higher than 0.7 for good cells. The fill factor diminishes as the cell temperature is increased.

The open circuit voltage increases logarithmically with the ambient irradiation, while the short circuit current is a linear function of the ambient irradiation. The dominant effect with increasing cell's temperature is the linear decrease of the open circuit voltage, the cell being thus less efficient. The short circuit current slightly increases with the cell temperature

## REFERENCES

1. Wang Nian CHun,Wu MeiYue, SHi GuoSHeng "Study on characteristics of photovoltaic cells based on MATLAB simulation" 2011 IEEE,978-1-4244-6255-1/11/\$26.00 ©2011 IEEE
2. Dominique Bonkoungou, Zacharie Koalaga, Donatien Njomo."Modelling and simulation of photovoltaic module considering single diode equivalent circuit model in MATLAB " ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 3, Issue 3, March 2013)
3. Tarak Salmi, Mounir Bouzguenda, Adel Gastli, Ahmed Masmoudi MATLAB/Simulink Based Modelling of Solar Photovoltaic Cell International journal of renewable energy research tarak salmi vol 2 no 2 2012
4. A complete Model of stand alone Photovoltaic array in Matlab simulink environment R. Rahmani, M. Fard, A. A. Shojaei, M. F. Othman, R. Yusof. 2011 IEEE Student Conference on Research and Development.