STAND ALONE PHOTOVOLTAIC ARRAY WITH PERTURB AND OBSERVE TECHNIQUE

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ABSTRACT

Stand alone photo voltaic array simulation model is presented in this paper. As the cost of solar panel is high so an efficient battery charger is required. In this paper Maximum power point tracking is implemented. The model is developed using single diode model and effect of solar irradiation and temperature are also included. Here perturb and observe technique is also implemented. [1]

Keywords* : *PV-Array, PV-Stand Alone System, Circuit Equivalent Model, Modeling.

I INTRODUCTION

Thermal power plant is mainly used to produce electricity, but the problem with them is the pollution. The excessive use of thermal power plant causes the reduction in air quality .An clean and green alternate to this problem is solar power. This can be harvested in two ways, one is solar thermal power plant and simple other one is solar cell or photovoltaic cell.

A photo voltaic cell converts solar energy directly into electricity. The basic of this device is when irradiation fall on it voltage is generated. These cells can be grouped in array or panel to get desired voltage and currents. When these panels are arranged in a particular form they are called photovoltaic array. Most of the people interested in modeling of photo voltaic panels. This paper focus on modeling photo voltaic modules or panels.

The electricity generated from the array can be feed directly to small dc loads like motors .Some application are required electronic converters to process electricity from PV array.

II MODELING OF PV PANEL

Fig 1.shows the equivalent circuit of the ideal photo voltaic cell. The basic equation from the theory of semi conductor that mathematically describe the I-V characteristics of the ideal photo voltaic cell is given by equation (1) . This basic equation is used to simulate the solar cell.

1. $I = Iph -$ ..... (1

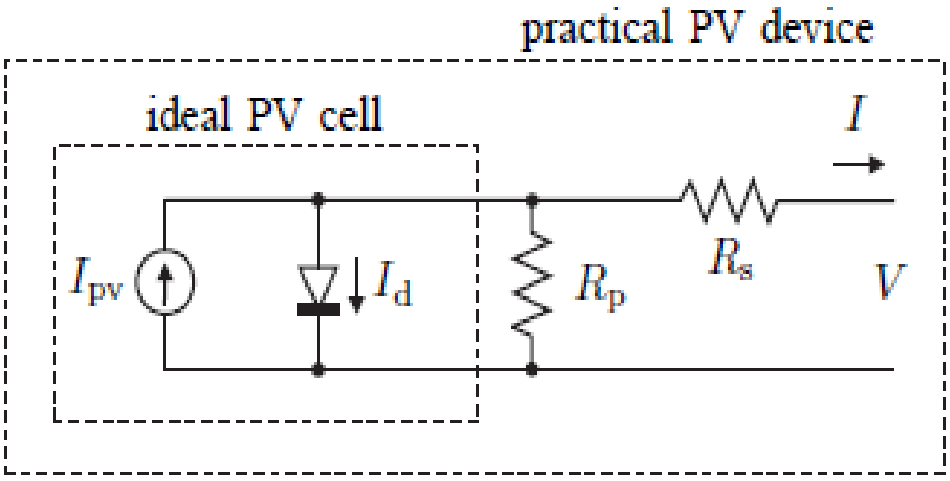

Fig.1.Single-Diode Model of the Theoretical Photovoltaic Cell and Equivalent Circuit of a Practical Photovoltaic Device Including The Series And Parallel Resistances.

III NOMENCLATURE

I_{PV}, V_{PV} - Solar cell current and voltage

I_D, V_D - Diode current and voltage

Iph – Irradiation current (generated by solar light)

G – Solar Irradiance (W/m^2)

T - Temperature

a - Diode ideality factor

K - Boltzmann's constant

e - Electron charge

Ir - Reverse saturation current

Rsh, Rse - Shunt and series resistance

Vt - Thermal voltage(= nkT/q)

δV, δI - Ripple voltage and current

Ts,fs - Switching period & Frequency

D - Duty ratio .

IV THE MPPT CONTROL ALGORITHMS

Perturb and Observe: The P&O method gets its name from how it works. The algorithm will change (perturb) the voltage of the PV panel (by changing the duty cycle), and then measure (observe) how the power changes. If the power increases, the voltage will continue to be changed in this direction. If a change in voltage causes a decrease in power, the voltage will then be changed in the other direction.

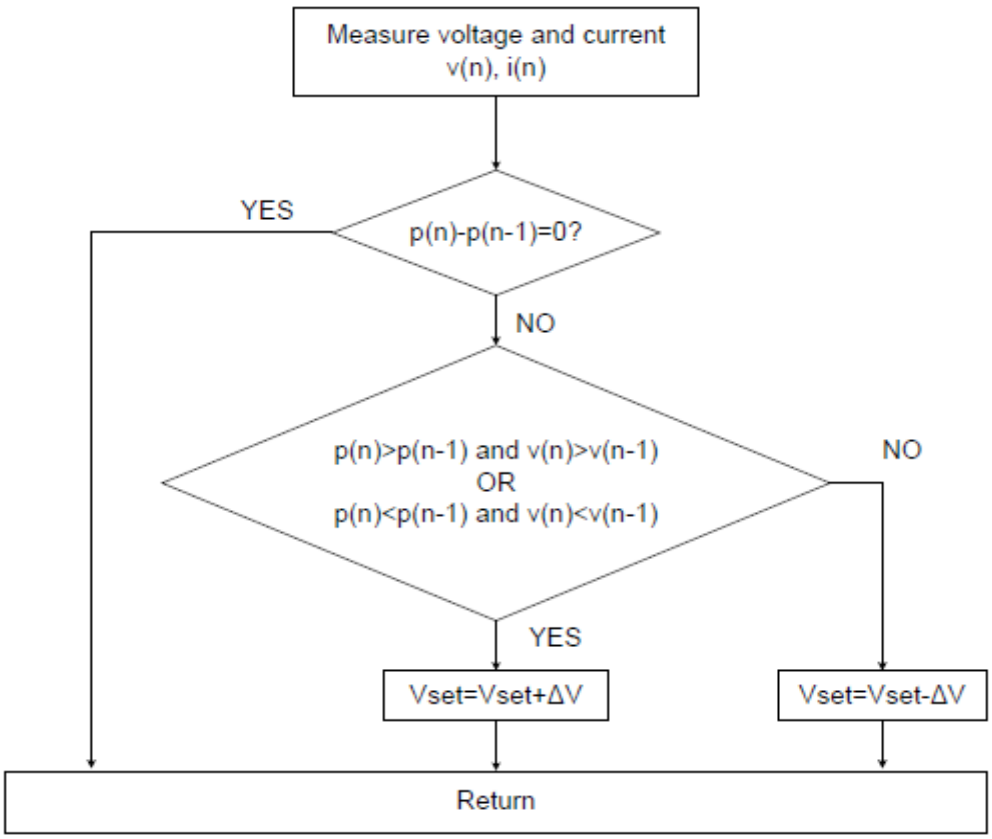

Fig. 2: Perturb and Observe MPPT algorithm.

V SIMULATION & RESULTS

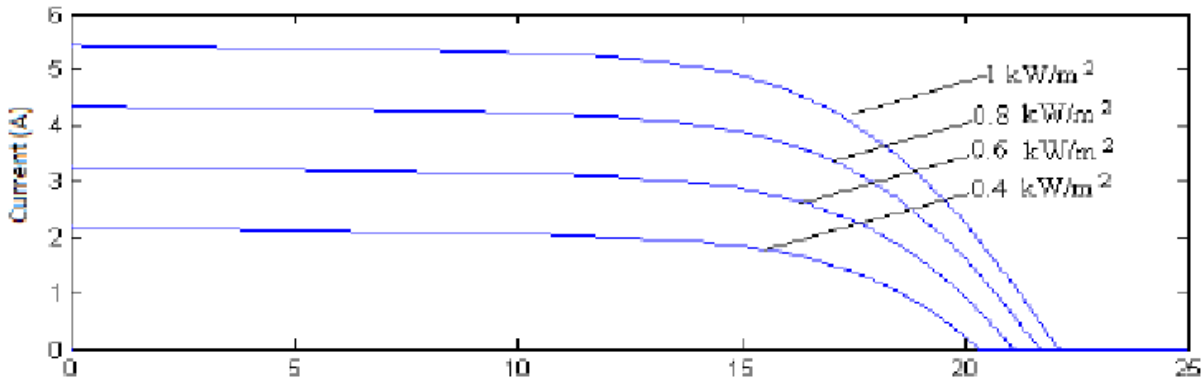

Fig.3. Current Vs Voltage curve

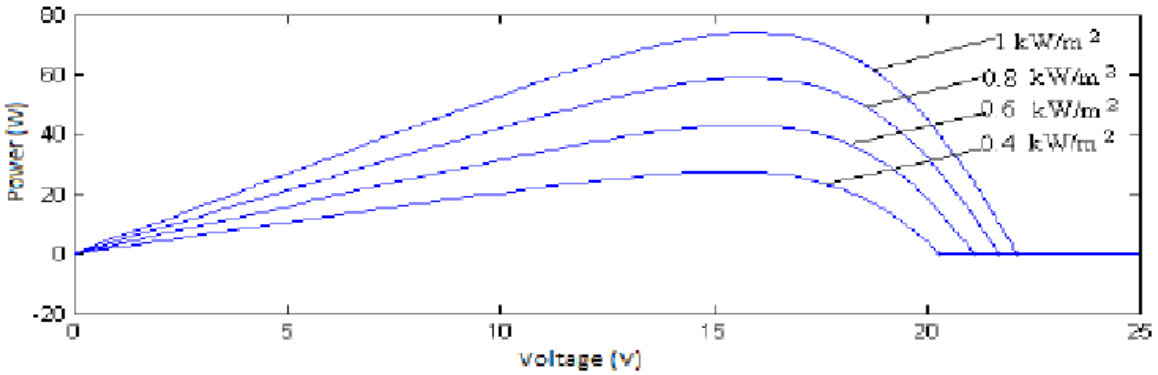

Fig.4. Curves between power and voltage

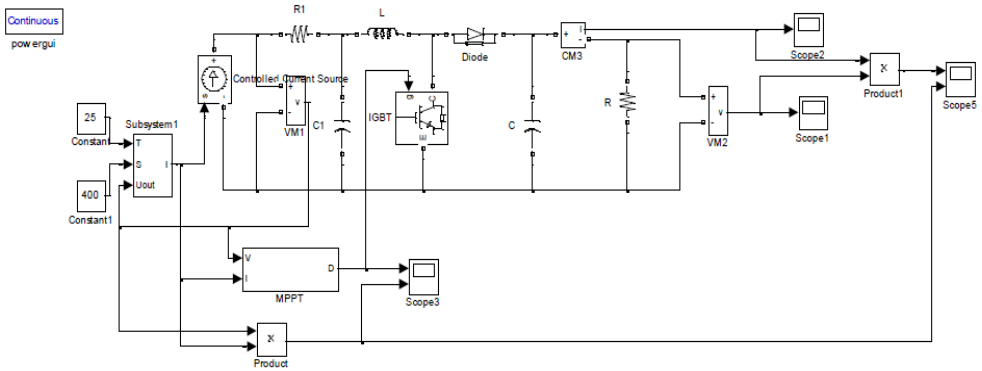

Fig.5. Simulation Model of P N O in MATLAB

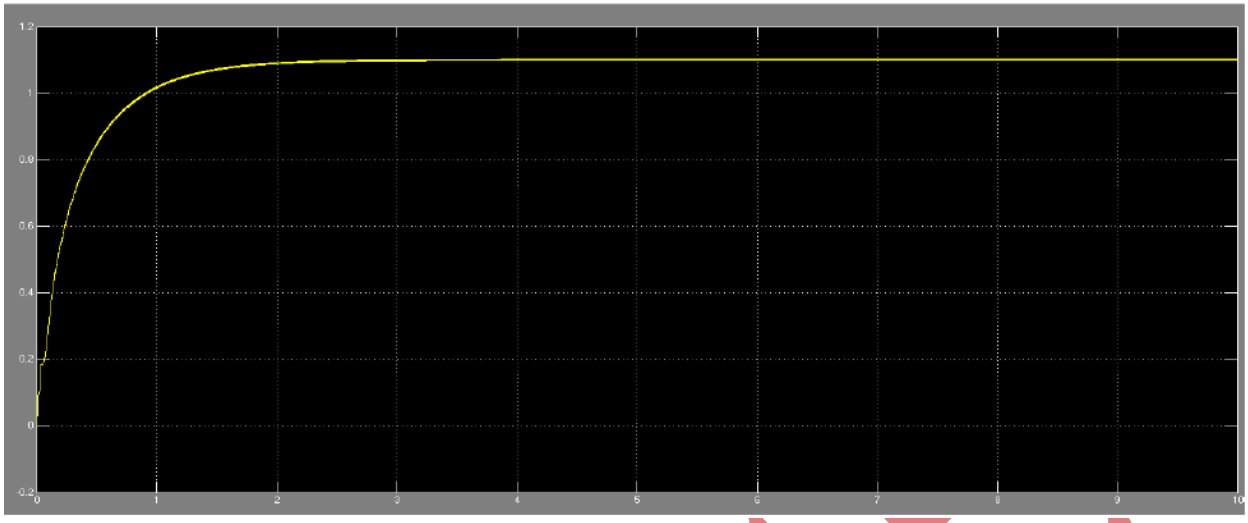

Fig.5. Output current

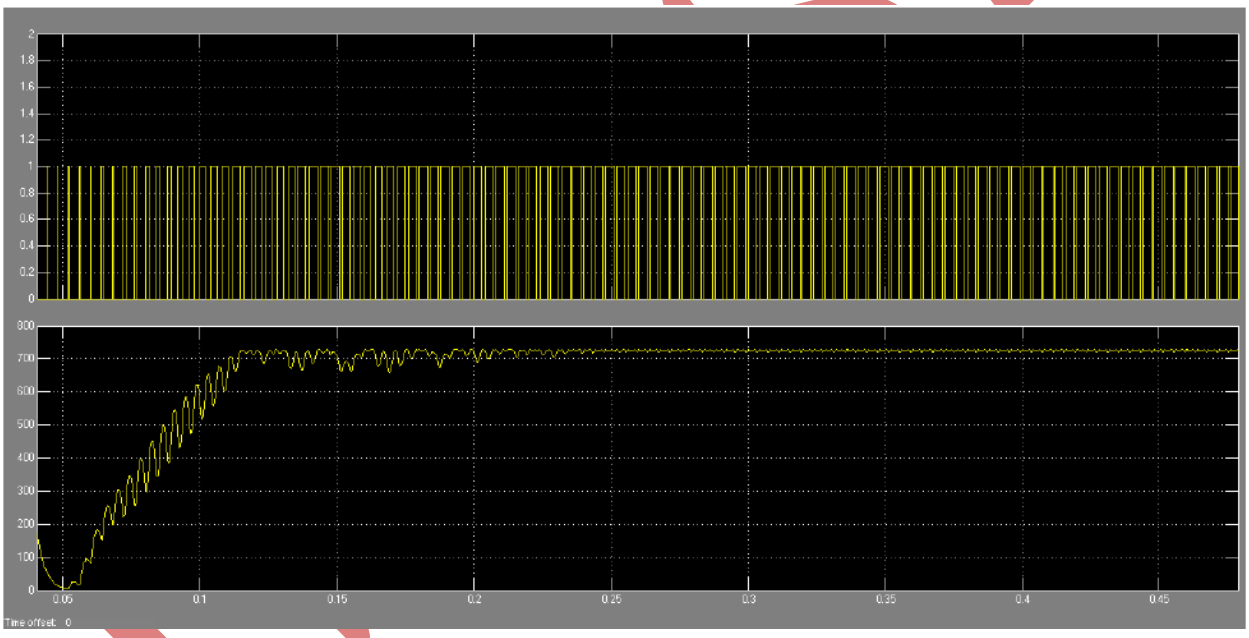

Fig.6. Input signal for switching and input power.

VI CONCLUSION

All the curves and waveforms are drawn and studied to see the working of perturb and observe technique. It is also observe that this technique improves the power output but also increases the oscillation in output. But if we consider the cost of photovoltaic array its efficient to use any MPPT technique.

REFERENCES

[1] "Design and modeling of standalone solar photo voltaic charging system", Sree Manju B, International journal of computer application (0975-887) Volume 18-No.2 march 2011.

[2] "Modeling and circuit based simulation of photovoltaic arrays", M.G. Villalva, Brazillian journal of power electronics, 2009vol14 no1.

[3] "Comprehensive Approach to Modeling and Simulation of Photovoltaic Arrays", Marcelo Gradella, Villalva, Jonas, Rafael Gazoli, and Ernesto Ruppert Filho,IEEE TRANSACTIONS ON POWER ELECTRONICS, VOL. 24, NO. 5, MAY 2009.

[4] "A MATLAB-Simulink-Based PV Module Model and Its Application Under Conditions of Nonuniform Irradiance",Kun Ding, XinGao Bian, HaiHao Liu, and Tao Peng, IEEE TRANSACTIONS ON ENERGY CONVERSION, VOL. 27, NO. 4, DEC 2012.

[5] "Perturb and Observe versus Incremental Conductance MPPT Algorithms", Thomas Bennett, Ali Zilouchian and Roger Messenger, IEEE TRANSACTIONS ON POWER SYSTEMS.

[6] Muhammad .H. Rashid, ―Introduction to Buck-Boost converter design‖, Third edition, Pearson education.

[7] "Incremental Conductance Based Maximum Power Point Tracking (MPPT) for Photovoltaic System" M. Lokanadham, / International Journal of Engineering Research and Applications. Vol. 2, Issue 2, Mar-Apr 2012, pp.1420-1424