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Simulation of Photovoltaic Cell Using Matlab

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----------ABSTRACT----------
The rapid trend of industrialization of nations and increased interest in environmental issues recently led us to explore the use of renewable forms such as solar energy. Photovoltaic (PV)generation is gaining increased importance as a renewable source due to its advantages like absence of fuel cost,little maintenance, and no noise and wear due to the absence of moving parts, etc. in particular, energy conversion from solar cell arrays (SCAs) received considerable attention in the last two decades. Photovoltaic array simulations can be used to find better methods to implement (MPPT) maximum power point tracking control for efficient solar power system

KEY WORDS*: Photovoltaic (PV) cell, characteristics of PV cell, Matlab simulation*

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I. INTRODUCTION

Photovoltaic (PV) systems have been used for many decades. Today, with the focus on greener sources of power, PV has become an important source of power for a wide range of applications. Besides assisting in the reduction of the emission of greenhouse gases, they add the much- needed flexibility to the energy resource mix by decreasing the dependence on fossil fuels. Photovoltaic (PV) generation has many advantages such as cleanness maintenance-free, inexhaustible and noiselessness. However, PV generation also has some drawbacks that the installation cost of solar panels is high and conversion efficiency is very low. The efficiency and the electric power of PV generation are always changing with Weather conditions, ambient temperature and irradiation level. The purpose of MPPT system is to sample the output of the cells and apply the proper resistance (Load) to obtain maximum power for any given environmental conditions.

Many MPPT techniques have can be divided into following ways:

(1) Constant Voltage Tracking and “Look up table” method.
(2) Perturb and Observe method (P&O) “Hill climbing 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.

II. THE MODEL OF A PV CELL

Solar cells consist of a p-n junction fabricated in a thin wafer or layer of semiconductor (usually silicon). The common material is monocrystalline silicon or polycrystalline silicon. The simplest equivalent circuit of a solar cell is a current source in parallel with a diode. The output of the current source is directly proportional to the light falling on the cell (photocurrent *Iph*). During darkness, the solar cell is not an active device; it works as a diode, i.e. a p-n junction. It produces neither a current nor a voltage. However, if it is connected to an external supply (large voltage) it generates a current *ID*, called diode (*D*) current or dark current. The diode determines the I-V characteristics of the cell. In the dark, the I-V output characteristic of a solar cell has an exponential characteristic similar to that of a diode

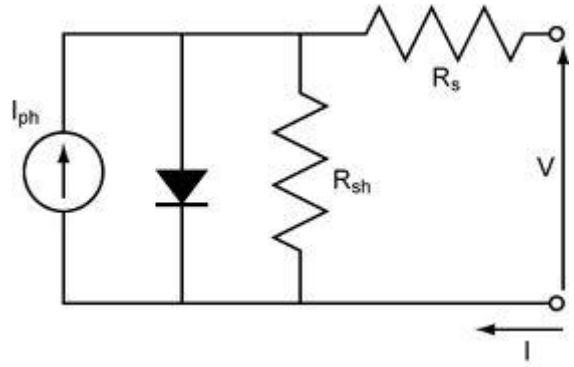


Fig.1 Equivalent circuit of solar cell model

The output current I is:

$$I = Iph - Is[\exp(V + IRs / NVt) - 1] - V + IRs / Rsh$$

$$Iph = IphoIr / Iro$$

$$Vt = KT / q$$

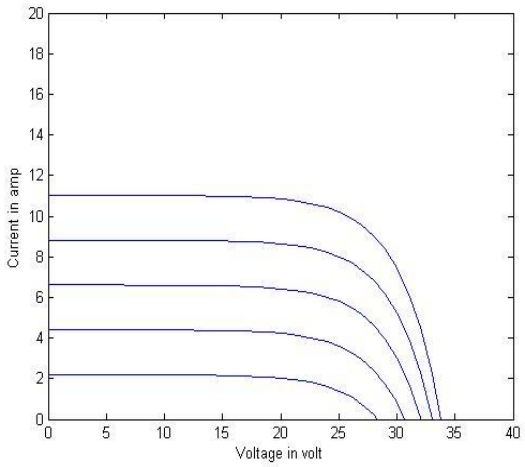
where:

Iph is the solar-induced current:

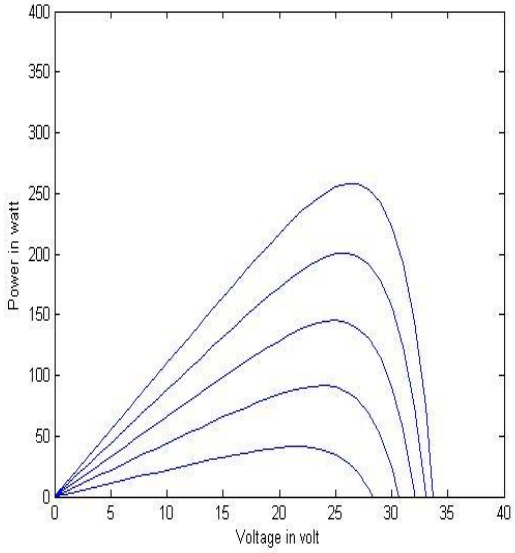
Ir is the irradiance (light intensity) in W/m2 falling on the cell.
Iph0 is the measured photo-generated current for the standard irradiance Ir0.
Isis the diode reverse saturation current.
k is the Boltzmann constant.
T is the measurement temperature parameter value.
q is the elementary charge of an electron.
V is the voltage across the solar cell electrical ports.
I is the output current of PV cell.
N is the diode ideality factor.
The Ideality factor varies for amorphous cells, and is typically 1-2 for polycrystalline cells.

III. SIMULATION OF PV CELLS

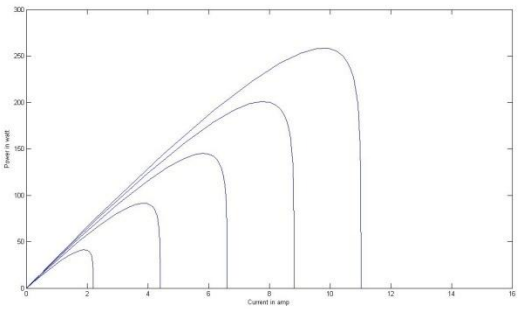
On account of mathematical model of PV cell Matlab simulation the output characteristics of PV cells. The output characteristics of Photovoltaic array is nonlinear and is influenced by solar irradiation level, ambient temperature, wind speed, humidity, pressure etc.



I-V CURVES OF PV CELL



P-V CURVES OF PV CELL



P-I CURVES OF PV CELL

IV. 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 simelecteronics (Matlab simulink) using solar cell model and other interfacing blocks. 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

REFERENCES

[1] Dominique Bonkoungou, Zacharie Koalaga, Donatien Njomo."Modelling and simulation of photovoltaic module considering single diode eqivalent circuit model in MATLAB " ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 3, Issue 3, March 2013)

[2] 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

[3] 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

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