INTERNATIONAL JOURNAL OF RESEARCH – GRANTHAALAYAH

A knowledge Repository

Science

A REVIEW OF EXPERIMENTAL STUDY OF POWER QUALITY MEASUREMENT OF PHOTOVOLTAIC CELLS WITH MAXIMUM POWER POINT TRACKING SYSTEM

Smriti Dwivedi [1], Prof. Sunil Kumar Bhatt [2]
[1] Research scholar, Central India institute of Technology, Indore, (M. P.), INDIA
[2] Assistant Professor, Central India institute of Technology, Indore, (M. P.), INDIA

ABSTRACT

Maximum power point tracking (MPPT) is a technique that charge controllers use for wind turbines and PV solar systems to maximize power output. PV solar systems exist in several different configurations. The most basic version sends power from collector panels directly to the DC-AC inverter and from there directly to the electrical grid. A second version, called a hybrid inverter, might split the power at the inverter, where a percentage of the power goes to the grid and the remainder goes to a battery bank. The third version is not connected at all to the grid but employs a dedicated PV inverter that features the MPPT. In this configuration, power flows directly to a battery bank.

Keywords:
MPPT, Photovoltaic Cells, electrical grid.

Cite This Article: Smriti Dwivedi, and Prof. Sunil Kumar Bhatt, "A REVIEW OF EXPERIMENTAL STUDY OF POWER QUALITY MEASUREMENT OF PHOTOVOLTAIC CELLS WITH MAXIMUM POWER POINT TRACKING SYSTEM" International Journal of Research - Granthaalayah, Vol. 4, No. 8 (2016): 152-156.

1. INTRODUCTION

A variation on these configurations is that instead of only one single inverter, micro inverters are deployed, one for each PV panel. New MPPT equipped specialty inverters now exist that serve three functions: grid-connecting wind power as well as PV solar power, and branching off power for battery charging.

2. CONSTANT VOLTAGE

The term "constant voltage" in MPP tracking is used to describe different techniques by different authors, one in which the output voltage is regulated to a constant value under all conditions and one in which the output voltage is regulated based on a constant ratio to the measured open

circuit voltage (V_{OC}). The latter technique is referred to in contrast as the "open voltage" method by some authors. If the output voltage is held constant, there is no attempt to track the maximum power point, so it is not a maximum power point tracking technique in a strict sense, though it does have some advantages in cases when the MPP tracking tends to fail, and thus it is sometimes used to supplement an MPPT method in those cases.

3. MPPT PLACEMENT

Traditional solar inverters perform MPPT for the entire PV array (module association) as a whole. In such systems the same current, dictated by the inverter, flows through all modules in the string (series). Because different modules have different I-V curves and different MPPs (due to manufacturing tolerance, partial shading, etc.) this architecture means some modules will be performing below their MPP, resulting in the loss of energy.

Some companies (see power optimizer) are now placing maximum power point tracker into individual modules, allowing each to operate at peak efficiency despite uneven shading, soiling or electrical mismatch.
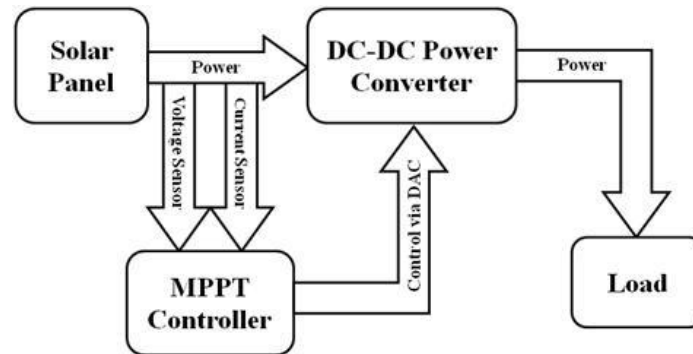

Figure 1: Maximum Power Point tracking

Data suggests having one inverter with one MPPT for a project that has east and west-facing modules presents no disadvantages when compared to having two inverters or one inverter with more than one MPPT.

4. LITERATURE REVIEW

DINESHKUMAR.(2013)- Maximum Power Point Tracking (MPPT) is used to optimize photovoltaic cells power. Maximum power is tracked with the help of maximum power point tracking algorithms. Beta algorithm is a type of MPPT algorithm. Beta algorithm is having fast tracking ability in different atmospheric conditions. Algorithms are used to calculate the duty cycle for DC-DC converter. Calculation of duty cycle is depending on photovoltaic cells output voltage and current. Output power of DC-DC converter is measured in order to verify the algorithm in different irradiation levels in photovoltaic cells.

Mr. S. K. Patil - Maximum Power Point Tracking (MPPT) is used in photovoltaic systems to maximize the photovoltaic array output power, irrespective of the temperature, irradiation conditions and electrical characteristics of the load. A new MPPT system is developed, consisting of DC to DC converter, which is controlled by a microcontroller based unit. There are

two charging stages for the proposed PV charger. At the beginning of the charging process, a continuous MPPT-charging scheme is adopted. When the State of Charge (SOC) of battery reaches a given condition, a pulse-current-charging scheme with an adaptive rest period is applied to obtain an average charging current with an exponential profile.

Dr.Anil S. Hiwale1(2014)- In this paper Maximum power point tracker battery charger is proposed for extracting maximum power from a photovoltaic panel to charge the battery. The output power of the PV system continuously varies with change in irradiance and temperature. It is very important to improve the efficiency of charger. There are number of maximum power point tracking (MPPT) methods available to operate the PV system at maximum power point. The proposed system have used Perturb & Observe (P&O) MPPT algorithm for the design and implementation. When irradiance and temperature are constant or slowly varying, the P&O method tracks MPP steadily and calculate the operating point at which the battery is capable of producing maximum power. In this method, the controller provides the PWM signal to adjust the voltage, adjustment is done by Buck converter and measures power, if the power increases, further adjustments in that direction are tried until power no longer increases.

J. Surya Kumari(2011)- Photovoltaic systems normally use a maximum power point tracking (MPPT) technique to continuously deliver the highest possible power to the load when variations in the isolation and temperature occur, Photovoltaic (PV) generation is becoming increasingly important as a renewable source since it offers many advantages such as incurring no fuel costs, not being polluting, requiring little maintenance, and emitting no noise, among others. PV modules still have relatively low conversion efficiency; therefore, controlling maximum power point tracking (MPPT) for the solar array is essential in a PV system.

Rakesh R(2014)- According to the present In order to maintain the economic growth rate of 8-9%, India needs to generate more and more of electric power. Nowadays Renewable Energy (RE) systems and technologies are gaining mass importance in the world. There are various types of RE technologies. RE generates either DC power or AC power depending upon the type and natural behaviour. The present scenario is tempting us to connect more and more RE systems to Grid. The most commonly used renewable energy resources is solar because it is noise free and clean due to this reason PV system which is gaining much more importance in the present condition.

5. OPERATION WITH BATTERIES

At night, an off-grid PV system may use batteries to supply loads. Although the fully charged battery pack voltage may be close to the PV panel's maximum power point voltage, this is unlikely to be true at sunrise when the battery has been partially discharged. Charging may begin at a voltage considerably below the PV panel maximum power point voltage, and an MPPT can resolve this mismatch.

When the batteries in an off-grid system are fully charged and PV production exceeds local loads, an MPPT can no longer operate the panel at its maximum power point as the excess power has no load to absorb it. The MPPT must then shift the PV panel operating point away from the peak power point until production exactly matches demand. (An alternative approach commonly

used in spacecraft is to divert surplus PV power into a resistive load, allowing the panel to operate continuously at its peak power point.)

In a grid connected photovoltaic system, all delivered power from solar modules will be sent to the grid. Therefore, the MPPT in a grid connected PV system will always attempt to operate the PV modules at its maximum power point.

A MPPT, or maximum power point tracker is an electronic DC to DC converter that optimizes the match between the solar array (PV panels), and the battery bank or utility grid. To put it simply, they convert a higher voltage DC output from solar panels (and a few wind generators) down to the lower voltage needed to charge batteries. Solar cells are neat things. Unfortunately, they are not very smart. Neither are batteries - in fact batteries are downright stupid. Most PV panels are built to put out a nominal 12 volts. The catch is "nominal". In actual fact, almost all "12 volt" solar panels are designed to put out from 16 to 18 volts. The problem is that a nominal 12 volt battery is pretty close to an actual 12 volts - 10.5 to 12.7 volts, depending on state of charge. Under charge, most batteries want from around 13.2 to 14.4 volts to fully charge - quite a bit different than what most panels are designed to put out.

6. PHOTOVOLTAIC CELLS

A solar cell (or Photovoltaic Cell) is a device that produces electric current either by chemical action or by converting light to electric current when exposed to sunlight. For the sake of this article, attention will be given to solar cells only.
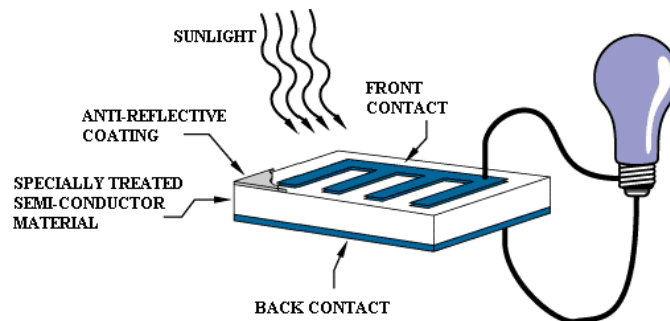

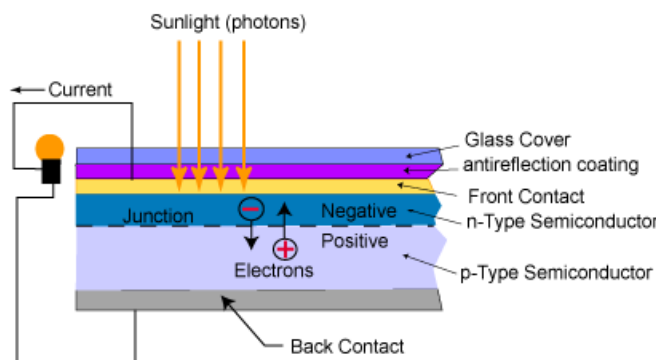*Figure 2:* Photovoltaic Panels

Figure 3: Electrons flow in Photovoltaic Panels

In solar cells, the amount of electrical energy generated by the cells depends on the intensity of em radiation that reaches the surface of the cell. Solar cell converts em radiation to DC current. Thus we can say that a solar cell is a semiconductor junction device that converts electromagnetic radiation reaching us from the sun to electrical energy. As stated above, the current generated is DC.

7. *REFERENCES*

[1] *Moacyr Aureliano Gomes de Brito, Luigi Galotto, Jr., Leonardo Poltronieri Sampaio, Guilherme de Azevedo e Melo, and Carlos Alberto Canesin "Evaluation of the Main MPPT Techniques for Photovoltaic Applications" IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, vol. 60, no. 3, March 2013 pp 1156-1167*

[2] *M. Lokanadham, K. Vijaya Bhaskar "Incremental Conductance Based Maximum Power Point Tracking (MPPT) for Photovoltaic System", International Journal of Engineering Research and Applications (UERA) ISSN: 2248-9622 Vol. 2, Issue 2, Mar-Apr 2012, pp. 1420-1424.*

[3] *Comparison Study of Maximum Power Point Tracker Techniques for PV Systems Hairul Nissah Zainudin Center of Foundation in Sciences, CyberjayaUniversity College of Medical Sciences, Cyberjaya, Selangor, Malaysia. hairulnisa@cybermed.edu.my, Saad Mekhilef Department of Electrical Engineering, University of Malaya Kuala Lumpur, Malaysia.pp750- 755*

[4] *M. Azab, "A New Maximum Power Point Tracking for Photovoltaic Systems,"in WASET.ORG, vol. 34,2008, pp. 571-574*

[5] *Vikrant. A. Chaudhari, "Automatic Peak Power Traker for Solar PV Modules Using dSpacer Software.," in Maulana Azad National Institute Of Technology vol. Degree of Master of Technology In Energy. Bhopal: Deemed University, 2005, pp. 98*

[6] *J Surya Kumari, Ch Sai Babu et.al, "An Enhancement of Static Performance of Multilevel Inverter for Single Phase Grid Connected Photovoltaic modules", International journal of Recent Trends in Engineering, Academy Publishers, Finland, Vol. 3, No. 3, May 2010, pp.20-24.*

[7] *J Surya Kumari, Ch Sai Babu et.al, " Design and Investigation of Short Circuit Current Based Maximum Power Point Tracking for Photovoltaic System" International Journal of Research and Reviews in Electrical and Computer Engineering (IJRRECE) Vol. 1, No. 2, June 2011 ISSN: 2046-5149.*

[8] *J Surya Kumari, Ch Sai Babu et.al, Mathematical Model of Photovoltaic System with Maximum Power Point Tracking (MPPT) International Conference on Advances in Engineering and Technology, (ICAET-2011), May 27-28, 2011.*

[9] *Balakrishna S, Thansoe, Nabil A, Rajamohan G, Kenneth A.S., Ling C. J.', "The Study And Evaluation Of Maximum Power Point Tracking Systems", Proceedings Of International Conference On Energy And Environment 2006 (ICEE 2006), Organized by University Tenaga Nasional, Bangi, Selangor, Malaysia; 28-30 August 2006, pp.17-22.*

[10] *Jawad Ahmad, "A Fractional Open Circuit Voltage Based Maximum Power Point Tracker for Photovoltaic Arrays", Proceedings of 2nd IEEE International Conference on Software Technology and Engineering, ICSTE 2010, pp. 287-250.*