

# Functionality of a Photovoltaic System Connected in Grid Arrangement

Mohsin Ahmad<sup>1</sup> Vipin Jaiswal<sup>2</sup>

<sup>1,2</sup>M.Tech Student

<sup>1,2</sup>Department of Computer Science and Engineering

<sup>1,2</sup>Dr. A.P.J. Abdul Kalam Technical University Lucknow, Lucknow Institute of Technology, India

**Abstract**— This paper presents the proposed methodology and sun radiation which is provided to the Photovoltaic module, which creates the electrical force that is then created with the aid of the P&O, MPPT and boost converter to keep the input side voltage of the inverter constant for SP. Two separate PWM strategy is then used to generate the control signals for the three-stage inverter. The inverter is connected to the resistive load along with an inverter type L-C in which the harmonics are used to decrease from the inverter output. Inverter is operated by both SPWM and SVPWM modulation techniques and evaluated both the inverters' THD along with the filter output voltage at that point find that SVPWM strategy has less THD when compared with SPWM. And shows that the SVPWM approach is highly competent than the SPWM modulation of the sinusoidal pulse duration.

**Keywords:** PWM, SVPWM

## I. INTRODUCTION

Every day the requirement of power is incrementing very rapidly. To satisfy the interest the customary age framework is not sufficient on the grounds that the contribution of conventional force age is restricted like non-renewable energy source. Due to this the interest is attempted to satisfy by sustainable power source assets like sun-based vitality, wind vitality and so forth these assets are complimentary and therefore no expense is incurred for the fuel. As of late energy from sun is broadly utilized for generating power in the whole world. The energy from sun is widely available all over, liberated from cost and medium, no fluid is needed to consume the fuel, condition benevolent, boundless measure of assets. The different nation utilized the sunlight-based capacity to satisfy the heap request. To handle the current vitality emergency, one needs to build up a proficient way in which force must be removed from the approaching sun-based radiation. The force transformation components have been extraordinarily decreased in size in the previous scarcely any years. The improvement in power gadgets and material science has helped architects to come up exceptionally little yet incredible frameworks to withstand the powerful interest .But the hindrance of these frameworks is the expanded force thickness. Pattern has set in for the utilization of multi-input converter units that can viably deal with the voltage fluctuations. In any case, because of high creation cost and the low effectiveness of the frameworks they can barely contend in the serious markets as a prime force age source.

The sun based (PV) module is utilized for generating power from sun that is comprising of solar cell (SC). A SC is developed by doping of Si as well as Ge material. At a point when the sun beams fall on the solar panel (SP) the photon discover the vitality structure beams and built up a photograph current. As a result of this the SP resembles a current source. To accomplish the greatest force

from the SC the maximum power point tracking (MPPT) methods are utilized. These strategies are because that the illumination of sun is differing in nature. Today the exploration is proceeding to discover the best method to accomplish the ultimate power from SP. These strategies increment the productivity of SP and are helpful in the field of sustainable power source assets [3], [8]. The inverter is utilized for changing over the SP power to AC power for supplying it to the grid. Various techniques of modulation are utilized for changing control of inverter to acquire less THD yield. The significant two strategies are SPWM which is sinusoidal pulse width modulation while the other is SVPWM which is space vector pulse width modulation.

## II. LITERATURE SURVEY

The research for sustainable energy is high in demand. As of late analysts are attempting to discover the route by which we accomplish the greatest yield from these assets and utilize these sustainable power sources in better way. It is realized that the effectiveness of the SC is extremely low. To accomplish the utmost yield from SC the maximum power point tracking techniques are found. By making use of these MPPT strategies we get most power from SC. Analysts are attempting to discover the ways by which the utmost yield from the SC can be obtained for power enhancement and to satisfies the needs. The MPPT methods are best to acquire maximum output from PV panels.

The sustainable power source research field is currently on top research areas. As of late specialists are attempting to discover the route by which we accomplish the most extreme yield from these assets and can use these sustainable power sources in a better way. They realized that the proficiency of the SC is extremely low. To accomplish the most extreme yield from SP the power point tracking techniques are found. By using such MPPT procedures we acquire utmost power for SC. As of late the scientists are attempting to discover the way by which we can accomplish the maximized power from the SC and satisfies the needs. And for this MPPT methods are best to acquire highest output from SP.

These various researchers present the new techniques to achieve maximum power output from solar cell few are as follows.

Samimi and M.S.Zabini are present the concept of optimal size of photovoltaic system in varied climate [1].the describe how to choose the PV module according to the climate to achieve the maximum power from Pv module.

P.S. Revankar has said about the position control of panel according to the direction of sun movement to achieve the maximum power in better way and by this the solar radiation are put perpendicular to the panels [8].

M.Berrera has find out the most efficient technique from maximum power point tracking by comparing the different MPPT techniques. He has compared seven

maximum power point tracking method for this he also consider two different solar irradiation function to test the MPPT techniques [9].

Soras C. and V.Makros presented a Novel method for the optimum size of standalone Photovoltaic system. They find out the criteria of size selection of pv module according to the load [10].

Abdulhadi Varnham, M.Abdulrahman, S.Gurvinder present the concept of soft switching based controllers for increased the Photovoltaic Plant efficiency [13].

### III. MOTIVATION

The solar power generation is very important for meets the loads. But solar radiation is time varying is depend upon the temperature, irradiation, material by which panel is design and the future power generation is totally depend upon the solar energy. Because of this many researchers are given concept and algorithms to achieve the maximum power. The challenges of this field and new research area is motivates behind the projects.

#### A. Requirement of MPPT Algorithm

As we discussed above chapter that the efficiency of solar cell is very low. But presently the load demand increases very rapidly day by day. So, to achieve maximum output form solar cell or solar panel the maximum power point tracking algorithms [5] is playing a big role. Without these algorithms we can increased the efficiency of solar panel. The solar energy varying in nature so maximum power tracking algorithms trying to generate the maximum output from solar panel. Power-Voltage and Curent-Voltage curves of SC are non-linear in nature because of this non-linearity power to load is very difficult. The boost converter makes the output voltage constant when the duty cycle of boost converter is controlled by maximum power tracking algorithms [4], [8].

Thus for enhancing the efficiency of SP and make constant voltage across the load maximum power point tracking algorithms and boost converter is playing a big role. The boost converter is connected to load side to provide constant voltage to load and if power is converted from dc to ac then constant voltage applied across inverter.

#### B. Various MPPT Algorithms

Presently a number of maximum power point algorithms are used for achieving better output for solar cell. But recently two methods are widely used one is P&O (Perturb and observe) and other is IC (Incremental conductance) for increases the efficiency of solar panels. We discussed below few more method which lesser efficient to P&O and IC.

#### C. P&O Method

This method is also used in proposed system to increase the efficiency of solar panel. This method is widely because the sensors required for operation is very less [4] and [5]. In this method the input is voltage and current of solar panel and with help of these two signal we find out the power of solar panel and then we find the derivate of power and voltage

which are dip and dV. Then we find the  $\frac{dP}{dV}$ . The

controlling of this method is depend upon the ratio  $\frac{dP}{dV}$ .

When the  $\frac{dP}{dV}$  is positive then algorithm increases the value of voltage. This algorithms increases the voltage towards maximum power point until the value of  $\frac{dP}{dV}$  is reaches to negative.

This iteration repeats again and again until the maximum power point is not achieved. This algorithm is used where the solar radiation variation is very less. If the solar radiation is variations very rapidly and high then this algorithms efficiency is not very good.

In the perturb and observe method the voltage cannot reached the exact maximum power point but it is very near to the maximum power point.

#### D. Modified P & O Method

It is easy to obtain the I-V and P-V characteristics of a PV array, as shown in Fig. 4.1. Obviously, the P-V curve is of the "hill" form with a maximum power point (MPP). A large number of MPPT algorithms are developed according to the fact that the power-voltage characteristic has the maximum point, like the peak of a hill, such as two most commonly used methods- P&O method and INC method. Some modified methods have also been proposed in recent years based on that characteristic [1-6,11,13].

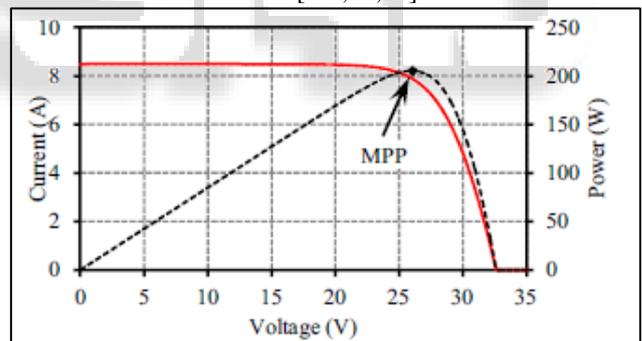


Fig. 4.1: Classic Current-Voltage (solid line) and Power-Voltage (dashed line) curves of a PhotoVoltaic array.

Concerning the P&O technique, in consistent express, the working point doesn't keep consistent yet sways around the MPP due to the annoyance. Another impediment of this technique is that the quickly changing air conditions may prompt disappointment of MPPT. This is a result of the way that this calculation can't decide the force changes brought about by bothering varieties or by irradiance changes [1]. The execution of the P&O method is influenced by the irritating (advance size),  $V_{stp}$ , as delineated in Fig. 2. Clearly, the MPP is arrived at when the force contrast is equal to zero,  $\square P=0$ . In this manner the decision of a huge  $V_{stp}$  can provide an optimizing reaction yet the followed voltage at MPP,  $V_{MPP}$ , is a long way from the hypothetical one,  $V_{MPPT}$ , which means that there will be more motions. On the off chance that  $V_{stp}$  has a small value, the MPPT is more slow, yet it despite everything has little oscillations.

Because of the irritating advances, the followed voltage at MPP cannot be equivalent to the hypothetical one. The motions can't be disposed of by diminishing the progression size.

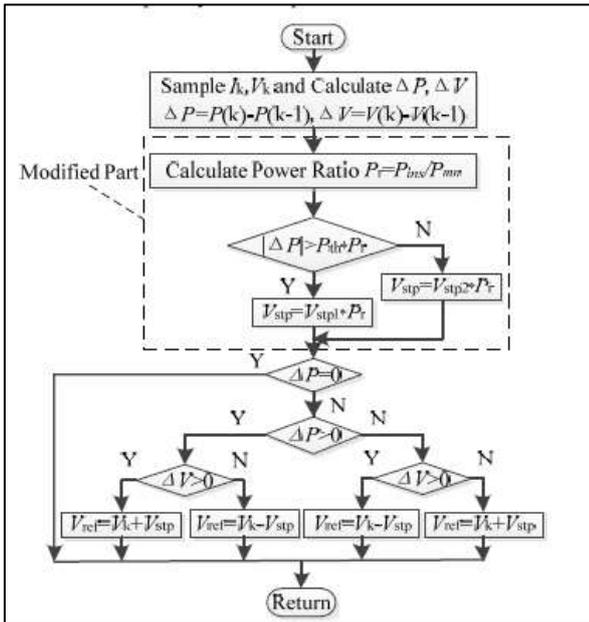


Fig. 4.2: Flow-chart of the modified P&O MPPT algorithm

#### E. IC Method

In this solar panel output voltage and output current is taken as input. Then it find out the  $\frac{dI}{dV}$  and  $\frac{dP}{dV}$ . This method find out the incremental conductance  $\frac{dI}{dV}$  by computing the sign of  $\frac{dP}{dV}$ . Where the value of  $\frac{dP}{dV} = 0$  then algorithms knows that the MPP is reached. In this way the calculation cycles stop and the estimation of voltage at the greatest force point is relating benefit of working voltage at most extreme force point. This strategy is very acceptable when contrasted with different techniques for most extreme force point following. This strategy is additionally utilized when the sun powered radiation is high. Yet, the hindrance of this technique is that it requires more sensors to perform effectively. Therefore the steady conductance strategy is required more sensors to work on account of this it builds the expense of framework [5], [6].it implies this technique for greatest force point following is monetarily less successful.

Different strategies are Constant Voltage strategy, Constant Current technique and parasitic capacitor technique. In the consistent voltage technique the misfortune is rely on the open circuit voltage and most extreme influence point voltage. This technique isn't generally utilized on the grounds that the controlling is rely on the open circuit voltage and most extreme force point following voltage and the apportion of both the two voltage is consistent for each sun oriented cell around 0.76 [8]. So this strategy isn't progressively effective for acquiring the most extreme force point voltage.

The steady current strategy is fundamentally the same as consistent voltage technique. The most extreme force point following is rely on the connection between open circuit voltage and greatest force point current. The proportion estimation of both two current is same for some sunlight based which almost around 0.95 [8].The cut off and working current is close about 95% of most extreme force point.

Furthermore, the last technique for most extreme force point following is parasitic capacitor. This technique is refreshed form of steady conductance strategy [5]. The improvement in the steady conductance strategy is just consider the parasitic capacitor in the most extreme force point voltage counts. So the parasitic capacitor technique is improve rendition of gradual conductance strategy.

#### F. Reason to Select Modified P&O Method

The modified P&O method having some advantage and some disadvantage. But this method is economically more effective than other maximum power point tracking method because it required less sensors to achieve the maximum power point voltage. This method is easily reaching near the maximum power point and method is simple and less effort is required to obtain the maximum power point. Modified P&O method also reduces the ripples in the voltage. If the voltage fluctuation occurs at maximum power point voltage and the solar radiation variation is very high, then the IC method is better than them P&O method. But the IC method is required more sensors for operation which is not economically effective, and the system became more costly and complex.

#### REFERENCES

- [1] M.G. Villalva, J.R.Gazoli,E.RuppertF, "Comprehensive approach to modeling and simulation of photovoltaic arrays", IEEE Transactions on Power Electronics, 2009 vol.25, no. 5, pp. 1198--1208, ISSN 0885-8993.
- [2] M.G. Villalva, J.R. Gazoli, E. Ruppert F, "Modeling and circuit-based simulation of photovoltaic arrays", Brazilian Journal of Power Electronics, 2009 vol.14, no.1, pp.35--45, ISSN 1414-8862.
- [3] Mummadi Veerachary, "Control of TI-SEPIC Converter for Optimal Utilization of PV Power", IICPE, 2010 New Delhi.
- [4] R.Sridhar, Dr. Jeevanathan, N.Thamizh Selvan, Saikat Banerjee, "Modeling of PV Array and Performance Enhancement by MPPT Algorithm", International Journal of Computer Applications (0975 – 8887) Volume7– No.5, September 2010.
- [5] Hairul Nissah Zainudin, Saad Mekhilef, "Comparison Study of Maximum Power Point Tracker Techniques for PV Systems", Cairo University, Egypt, December 19-21, 2010, Paper ID 278.
- [6] Katherine A. Kim and Philip T. Krein, "Photovoltaic Converter Module Configurations for Maximum Power Point Operation", University of Illinois Urbana-Champaign Urbana, IL 61801 USA.
- [7] Huan-Liang Tsai, Ci-Siang Tu, and Yi-Jie Su, "Development of Generalized Photovoltaic Model Using MATLAB/ SIMULINK", Proceedings of the

World Congress on Engineering and Computer Science  
2008 WCECS2008, October 22 -24, 2008, San  
Francisco, USA.

- [8] M. Berrera, A. Dolara, R. Faranda and S. Leva,  
“Experimental test of seven widely-adopted  
MPPT algorithms”, 2009 IEEE Bucharest Power Tech  
Conference, June 28th-July 2nd, Bucharest, Romania.
- [9] P.S. Revankar, W.Z. Gandhare and A.G. Thosar Govern  
ment College of Engineering, Aurangabad, “Maximum  
Power Point Tracking for PV Systems Using  
MATLAB/SIMULINK”, 2010 Second International  
Conference on Machine Learning and Computing.

