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An Interleaved High-Power Fly back Inverter for Photovoltaic Applications

S.Sudha Merlin
PG Scholar,
Department of EEE,
St.Joseph's College of Engineering,
Semmencherry, Chennai, Tamil Nadu, India.

R.G.Nirmala
Assistant Professor,
Department of EEE,
St.Joseph's College of Engineering,
Semmencherry, Chennai, Tamil Nadu, India.

ABSTRACT:

This project presents analysis, design, and implementation of an isolated grid-connected inverter for photovoltaic (PV) applications, based on a technique interleaved fly back converter topology operating in discontinuous current mode. The output power of the PV module is play a major role to controlling the, each phase of an interleaved flyback inverter. The concept of interleaving reduces the ripple and reduces the usage of capacitors. A MPPT control algorithm is implemented in this project for tracking the maximum power from PV panel. The simulation of this project is implemented in Matlab/ Simulink.

Index Terms: ***Flyback inverter, Photovoltaic (PV), discontinuous current mode, MMPT***

INTRODUCTION:

Now a day's solar power play a major role in electricity generation because of prime source of solar power is sun light and free of cost. And in our electricity market amount of energy resources is low when compare to actual demand to overcome the demand renewable energy is used [1] so that the research based on solar power in the [1-5] and in this existing system the energy storage inductor and the transformer are separate elements.Based on feedback control of the primary current and an open-loop control of the secondary current, is proposed in order to bypass the difficulties by the new technique moving right half plane zero in the duty cycle to secondary current transfer function is shown in [2] this paper is mainly focus on CCM but it have some drawback to overcome this process need DCM technique

This paper describes PV module architectures with parallel-connected sub module-integrated dc-dc converters that enhance efficiency of energy capture in the existing of partial shading or other mismatch conditions is in [3-5]. To conquer the operation new interleaved flyback converter is usedwhile the inductor is responsible for energy storage, the transformer on the other hand is responsible for energy transfer over a galvanic isolation. The combination of these two components in a flyback topology eliminates the bulky and costly energy storage inductor and therefore leads to a reduction in cost and size of the converter. But in that some drawback is there they are in real time implementation of a transformer with relatively large energy storage capability is always a challenge.

A flyback converter built with a transformer that has large leakage flux and poor coupling will have poor energy transfer efficiency.

Mainly for this reason, the flyback converters are generally not designed for high power. As a result, the flyback topology play a limited role in PV applications only at very low power as micro inverter it is shows in Fig1.

To overcome the normal flyback operation, we proposed a system that is Interleaved High-Power Fly back Inverter is used to get the application of photovoltaic in high power application.

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CIRCUIT DIAGRAM:

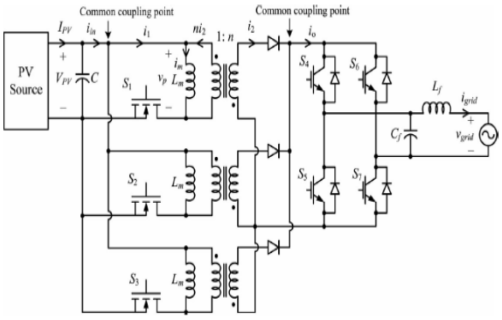

Fig1: circuit diagram

Circuit diagram of existing system in this circuit switching loss is highIt is shown in Fig1.

This will overcome from the proposed system by adding the soft switching technique this will maintain the switching losses.

BLOCK DIAGRAM OF PROPOSED SYSTEM:

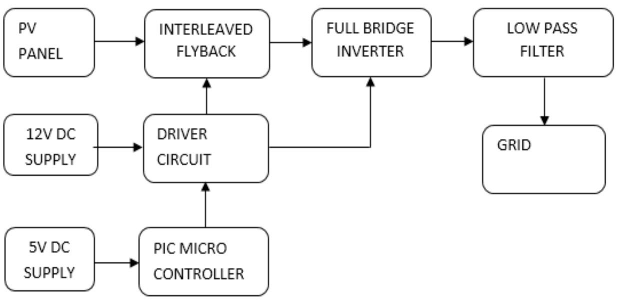

Fig2: proposed system block diagram

Fig2shows the block diagram of proposed methodology with interleaved flyback converter, due to this technique will overcome the large leakage flux and poor coupling will have poor energy transfer efficiency and this type converter is used in high power application but normal flyback is not used in high power application.

As mentioned before, the choice of operation mode for the converter is discontinuous current mode (DCM). The fundamental reason for selecting DCM operation are given.

1) It provides very fast dynamic response.

2) No reverse recovery problem. The diodes exhibits reverse recovery problems in CCM operation which cause noise, electromagnetic interference problems, and some other losses will occur. So, DCM operation is applicable for this process.

3) No turn on losses.

4) Small size of the transformer.

5) Easy to control, No need for a feedback loop for the control of the grid current

PV panel provide the dc voltage to the interleaved flyback converter, by using driver circuit

PROPOSED SYSTEM:

In this project, an interleaved high-power flyback inverter for photovoltaic applications is proposed. The flyback topology system is simple structure and easy power flow control with high power quality at the grid interface are the key motivations for this work. The flyback converter is recognized as the lowest cost converter among the isolated topologies since it need only the least number of components. This advantage comes from the ability of the flyback topology combining the energy storage inductor with the transformer.

Due to use of DCM lot of advantages are there when compare to CCM Actually It provides very fast dynamic response, No reverse recovery problem, No turn on losses and Easy to control, No need for a feedback loop for the control of the grid current

The converter is operated in DCM for easy and stable generation of ac currents at the grid interface.

Maximum power point is a unique operating point supplying maximum power to the load which is present in a PV system. by Tracking the maximum power point of the PV array is done to improve the efficiency of the PV energy system, MPPT is an electronic system that operates the Photovoltaic (PV) modules in a process that allows the modules to produce the power of PV module. The operations of this project can be implemented in Matlab / Simulink.

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MAXIMUM POWER POINT TRACKING:

Now a days MPPT algorithms are necessary in PV applications because the solar will generating some power but it is not sufficient to operate to get the maximum power point tracking technique is used, Solar panel varies with the irradiation and temperature of the sun, so the use of MPPT algorithms is required in order to obtain the maximum power from a solar array.

If the solar power is used maximum power point tracking control technique is must to get the efficient output form the solar power some MPPT algorithm

Are there they are given below:

- Hill-climbing techniques
- Perturb and observe
- Incremental conductance

PERTURB AND OBSERVE P&O:

The P&O algorithm is otherwise called “hill-climbing” algorithm, but both names are different but algorithm wise same, In Hill-climbing technique involves a perturbation on the duty cycle of the power converter and P&O a perturbation in the employing the voltage of the DC link between the PV array and the power converter. In the case of the Hill-climbing, perturbing the duty cycle of the power converter implicit modifying the voltage of the DC link between the PV array and the power converter, so both names are difference but the algorithm wise same technique only. In this method, the process of the last perturbation and the process of the last increment in the power are mainly used to decide.

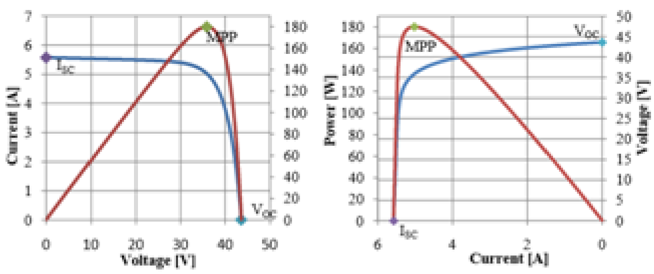

Fig3:a)current vs voltage graph b) power vs current

If there is an increment in the power, then the perturbation should be kept in the same direction and if the power decreases, then the next perturbation should be in the reverse direction. Based on these facts, the algorithm is implemented. The process is repeated until the MPP is reached Fig 3 a) shows the output current vs voltage graph of p&omethod

P&O ALGORITHM FLOW CHART:

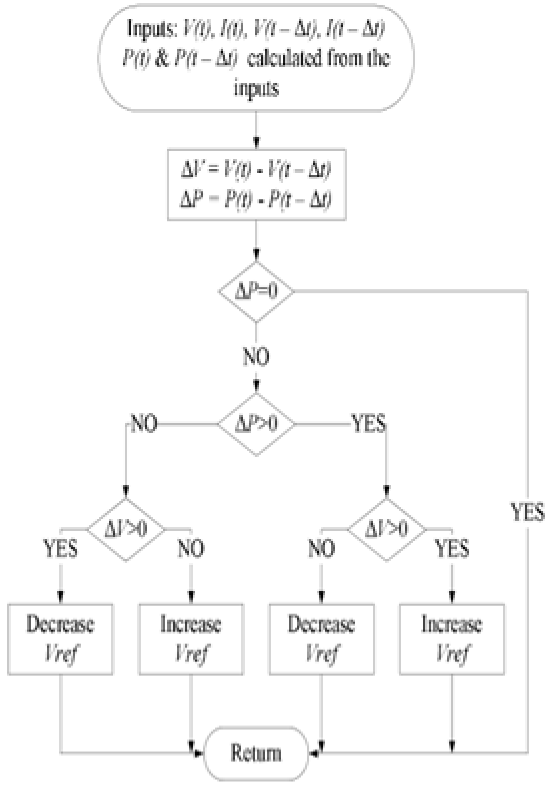

Fig4: flow chart of P&O method

Step by step operation of P&O method maximum power point tracking (MPPT) is shown in Fig4

MPPT protect that you get the most power possible from the solar panels at any point in time to get the maximum efficiency.

It is somewhat effective during low amount of sun light. These calculated result in an output that delivers maximum amount of current at the required voltage at any point in time of tracking. During low amount of

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light situations it will compensate for that level and find the valid point at which the solar cell delivers its maximum amount of power output.

PHOTOVOLTAIC MODULE:

High-quality (PV) modules are subject to a number of requirements as we need. First, they have to deliver the guaranteed of rated power and the system should be reliable, the system should withstanding the environmental conditions.

They must also be safe and long-lasting, ensuring the system's high yield over the long term. And, they should also able to generate the full amount of energy that was used to manufacture them in the shortest possible time.

PWM stands for Pulse Width Modulation, a method of creating the ac sine wave from the use of dc input supply.

This dc is given from the pv panel the source of panel is free renewable energy somewhat efficient to get the energy.

SIMULATION RESULTS FOR EXISTING SYSTEM:

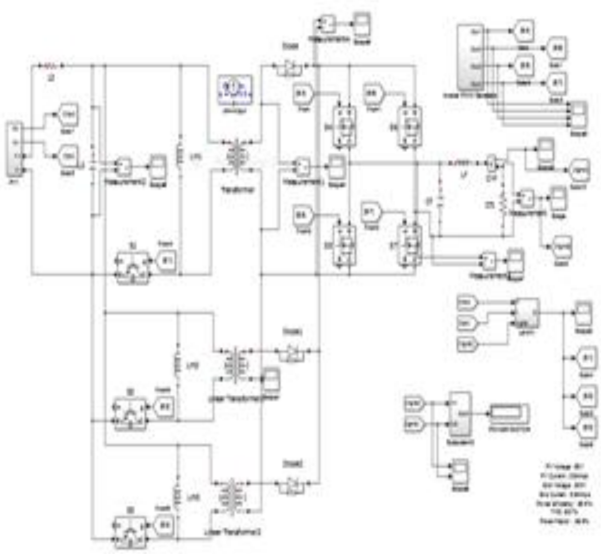

Fig5: circuit diagram of existing system

PV PANEL DESIGN:

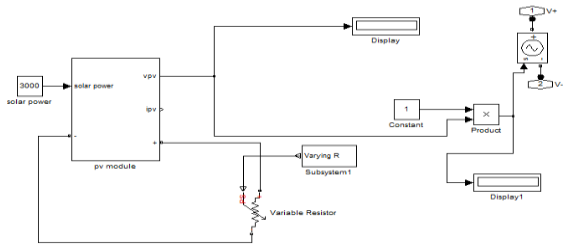

Fig6: PV panel design

INPUT VOLTAGE:

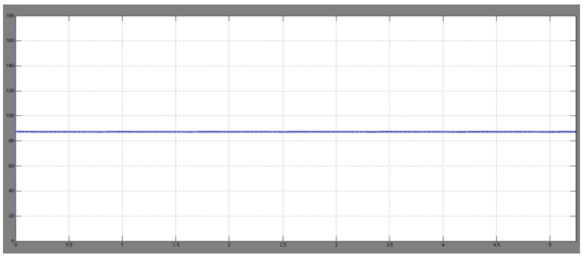

Fig7: input voltage

SWITCHING PULSE FOR INVERTER:

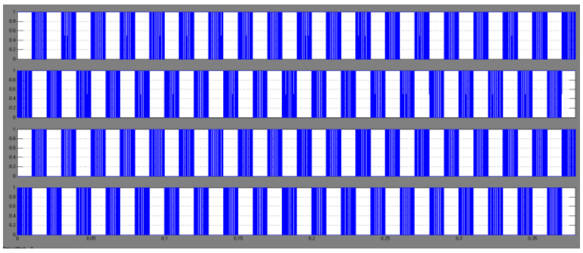

Fig8: switching pulse for inverter

Actually here inverter is used to get the ac supply to grid.

Grid connection is not possible it need three condition one is phase, voltage and frequency so it need four switches for that switches required gate pulse it is shown in Fig8

SWITCHING PULSE FOR FLYBACK CONVERTER:

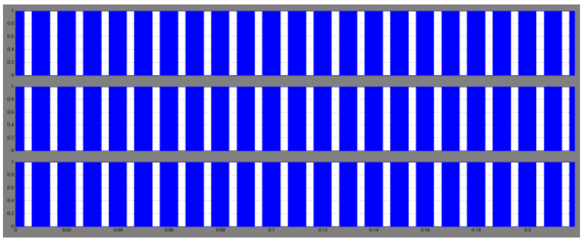

Fig9: switching pulse for flyback

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INVERTER OUTPUT:

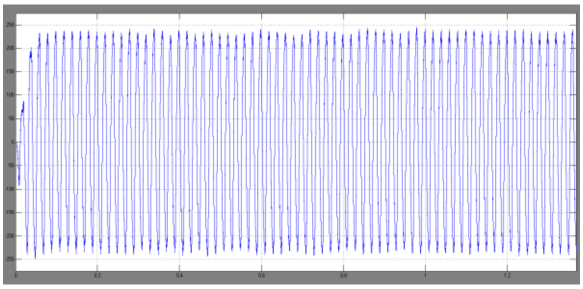

Fig10: inverter output

It is the output from the inverter this is connected to the grid
With synchronous voltage, phase and frequency

GRID VOLTAGE:

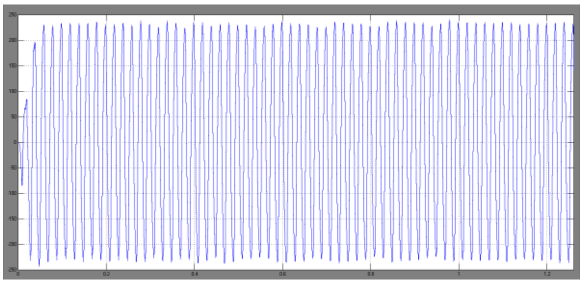

Fig11: Grid Voltage

GRID CURRENT:

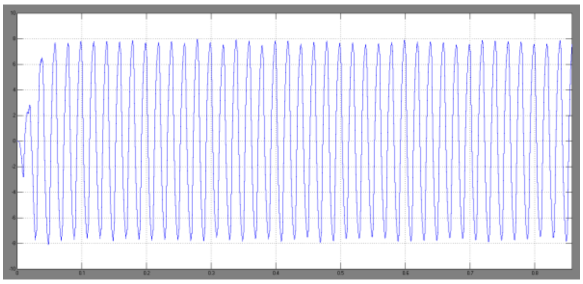

Fig12: Grid Current

POWER FACTOR:

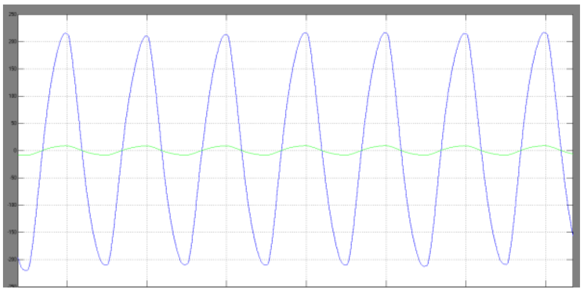

Fig13: power factor for existing system

The power factor is major role in power system to maintain the power factor in unity is must in power system.
Here in existing system the power factor is not that much of unity.
In this proposed system somewhat nearby to unity.

TOTAL HARMONIC DESTRUCTION (THD):

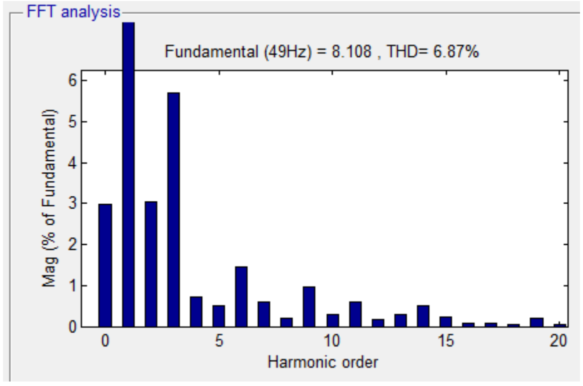

Fig14: THD

The harmonic of existing system is somewhat high it is shown in Fig14, to overcome this process proposed system is used.
This analysis is proposed by fast Fourier transform (FFT)

PROPOSED CIRCUIT DIAGRAM:

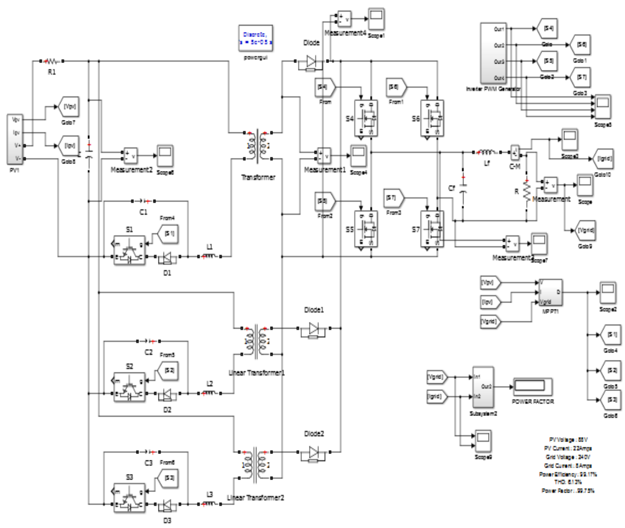

Fig15: circuit diagram

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PV PANEL:

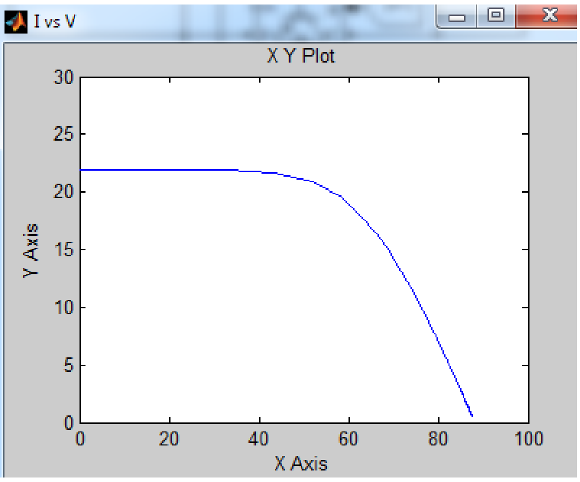

Fig16: proposed voltage vs current from PV

FLYBACK CONVERTER OUTPUT:

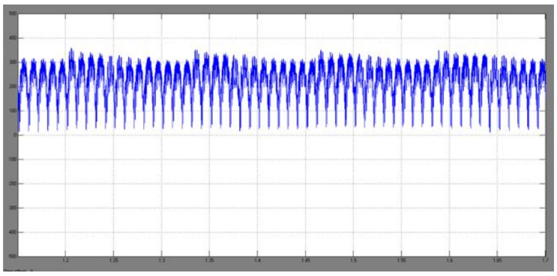

Fig17: proposed flyback output

INVERTER OUTPUT:

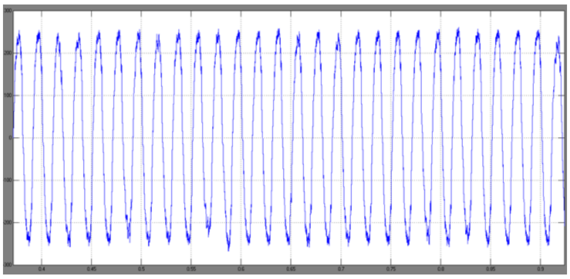

Fig18: proposed inverter output

GRID CURRENT:

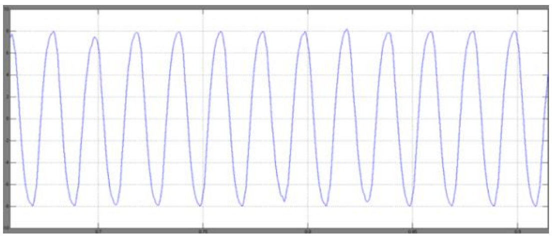

Fig19: proposed grid current

GRID VOLTAGE:

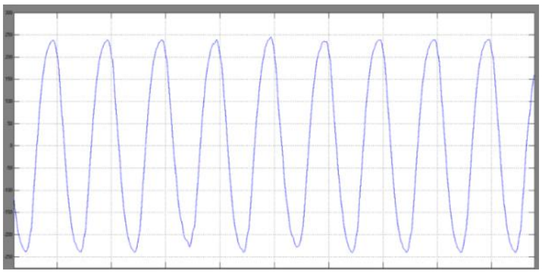

Fig20: proposed grid voltage

SWITCHING PULSES FOR INVERTER:

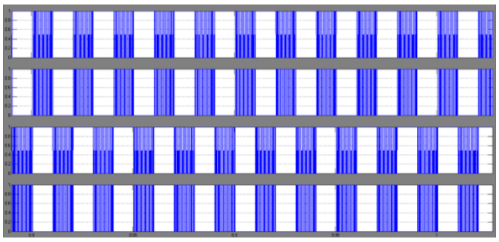

Fig21: proposed inverter pulse

POWER FACTOR CORRECTION:

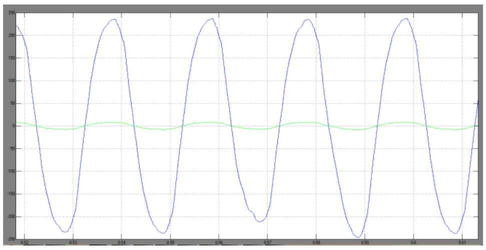

Fig22: proposed power

In the existing system power factor is not in phase in this proposed system it is nearly in phase 0.997 nearby unity it is shown in Fig22.

This is possible by soft switching technique in the existing system no soft switching

TOTAL HARMONIC DESTRUCTION (thd):

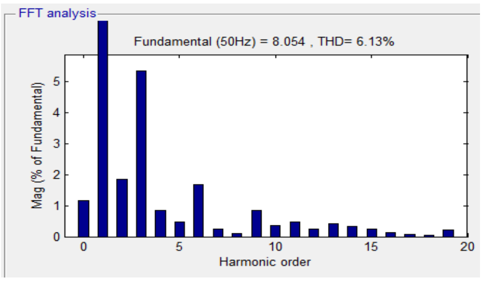

Fig23: proposed thd

This analysis is proposed by fastfourier transform (FFT). In this proposed system thd is somewhat reduced nearly 6.1 it is shown in Fig23

CONCLUSION

A low cost interleaved flyback inverter with sliding mode controller for AC system application has been proposed. Here the Sliding mode controller algorithm is used for tracking the maximum power from the PV panel. The interleaved flyback inverter is used to convert the direct current (DC) into alternating current (Ac). The total harmonic distortion of the interleaved flyback inverter is reduced by using the LC filter connected between inverter and load.

The main advantage of the interleaved flyback inverter is, it does not require any additional circuit to convert the low output voltage of PV panel into high voltage because it has capability to step up the voltage by using (MPPT) technique, that included in sliding mode controllers used for getting the maximum available of power from the PV module under certain conditions.

The voltage at which PV module can generate maximum power is called maximum power point or peak power voltage tracking. Maximum power varies with solar radiation, ambient temperature and solar temperature.