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Synchronisation of Grid with Power Inverter using Matlab with Solar

Aditya Mahule, Pranay Kurewar, Rakesh Aedulla, Jai Verma
Dept. of Electrical Engineering
Ballarpur Instituteof Technology
Ballarpur Maharashtra (India)

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ABSTRACT—In solar panel inverter, we use to provide the power supply to the residential load using inverter and if our residential load does if the output of the solar is not sufficient the amount of power generated by a solar power inverter as per the requirement of the load we can a absorbe or can be taken from the grid and when the generation is high of the solar inverterand the requirement of power is less by the load not then power is supplied to the power grid. If the grid voltage is 230V and the inverter supply is 300V then it means that we step down the inverter 300V supply voltage to the 230V, also the current and voltage are in phase with each other. The supply voltage from the solar panel is given to the DC to DC converter. Also the current and voltage from the solar panel is given as a gate signal to the converter through the MPPT. The supply voltage taken from the DC to DC converter is applied across the battery as well as across the residential AC load or to the power grid via PWM inverter. The inverter is utilized to change over direct present (DC) to alternating current (AC). Such a AC supply we can provide to the residential load as well as to the grid also, such a system we are designing using theMATLAB SIMULINK software.

I. INTRODUCTION :-

This research paper is mainly depend upon photovoltaic Cell (PV) technique. Using this techniques we have developed a system which is the combination of solar inverter & power grid. In this by using power improvement we have improved the value of PV system. The growth of PV system utilization and improvement is due to its advantages such as being cleaned, safe, reliable, inexhaustible, operation and maintenance costs are very low, and has no moving parts but its installation cost is relatively high.[1] The power generation of using photovoltaic cell is DC voltage and we converter such a DC voltage to AC voltage and feed to grid and residential load. But providing voltage to the DC to DC converter through the MPPT (Maximum Power Point Tracking) is the very first goal of this research. Gate signals are generate in MPPT because of the current and voltage, and this gate signal we are providing to the MOSFET of the converter. This MOSFET is used to generate the PWM signals and this PWM signals are providing to the DC to DC converter as a through PWM signal. The output of the dc to dc converter is connected to the inverter . It is a single phase inverter with 4 MOSFET. The phase lock loop generated by the grid is applied to the MOSFET as a gate supply and it's feedback is connected to single phase inverter. The sinusoidal wave is generated because of PLL is connected to the gate terminal of MOSFET. Such a sine wave is of low voltage but it is in AC nature. To boost this low voltage supply we are using step up transformer and it generate voltages in the range of 20V to 230V. This generated voltage we are applying to the residential load as well as to grid also.

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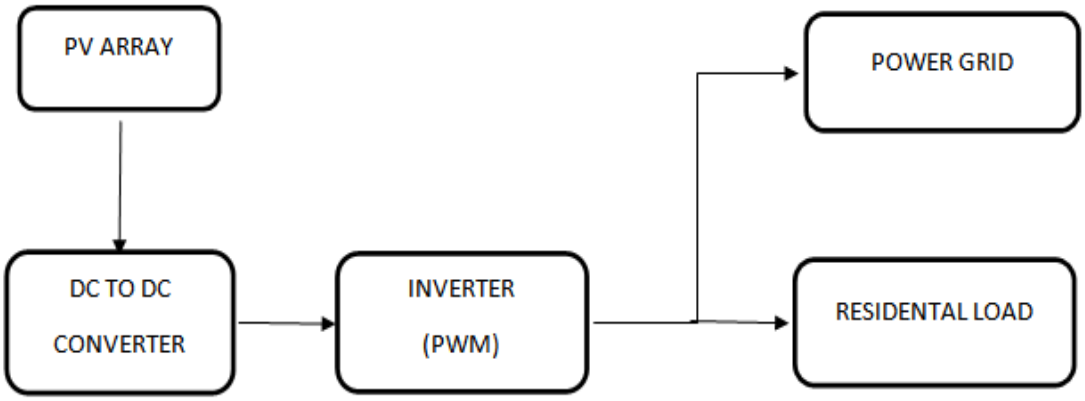

Fig :-1 Block diagram of Synchronisation of grid with power inverter using matlab with solar

II. METHODOLOGY:-

A. Solar cell modeling Solar based cells made of a p-n junction created in thin layer of semiconductors, whose electrical qualities vary practically very little from a diode represented by the condition of Shockley. Therefore the least complex comparable solar circuit based cell is a present source in parallel with a diode as appeared in Fig. 2. So the way toward equation.

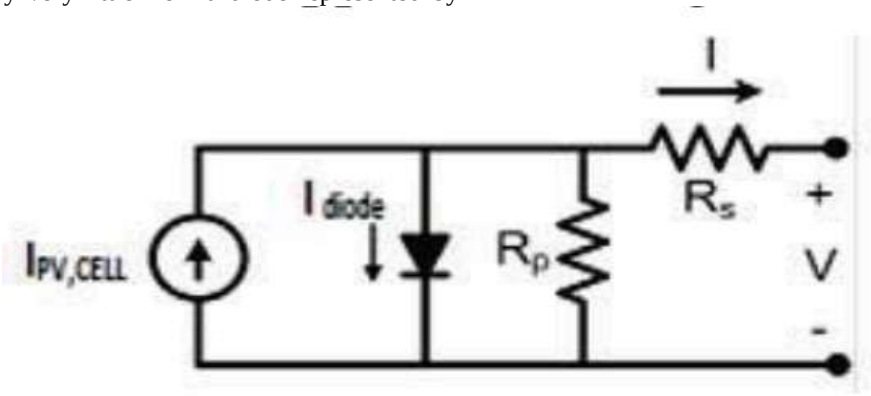

Fig.2: Equivalent Model of Solar Cell

$$I = I_{PV,CELL} - I_{DIODE} \quad (1)$$

$$I = I_{PV,CELL} - I_{O,CELL}\left[\exp\left(\frac{q+v}{\alpha+k+T}\right) - 1\right] \quad (2)$$

Where:-
$I_{pv,cell}$= Current generated by the incident light.
I_{Diode}= Shockley diode
I_{0cell}= Reverse Saturation current.
q = Electron charge (1.6021 x 10^{-19}).
k = Boltzmann constant (1.3805 x 10^{-23}).
T = PN junction diode Temperature.
α= Ideally constant (between 1 to 2).

B. DC to DC Converter:- Here we utilized Boost converter. It is one of the DC to DC converter. Boost converter is utilized to progress up a source voltage to a more raised sum. The primary parameter, for example, input and output voltage, inductance, capacitance and resistor values likewise with the obligation proportion were composed. The pick from boost converter is guide match up with the duty cycle (D). At the time that boost converter is in PV applications, the information voltage starting from PV panel is changed withnatural conditions. So, if the duty cycle move than we get generally amazing and interesting control

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motivation behind PV module. The simulink Model of boost converter is given.

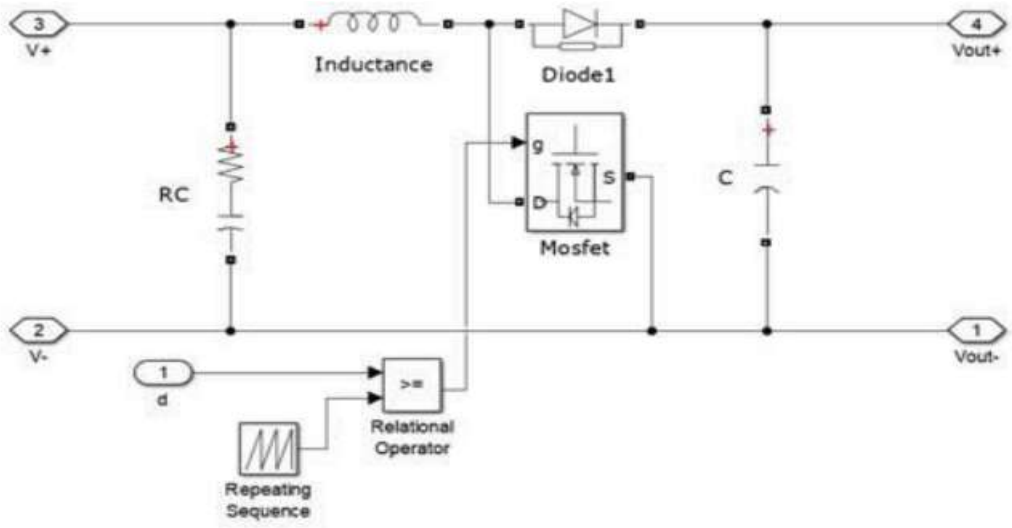

Fig. 3: Boost Converter

C. MPPT :-This area covers the operation of "Maximum Power Point Tracking" as utilized as a part of solar electric charge controllers

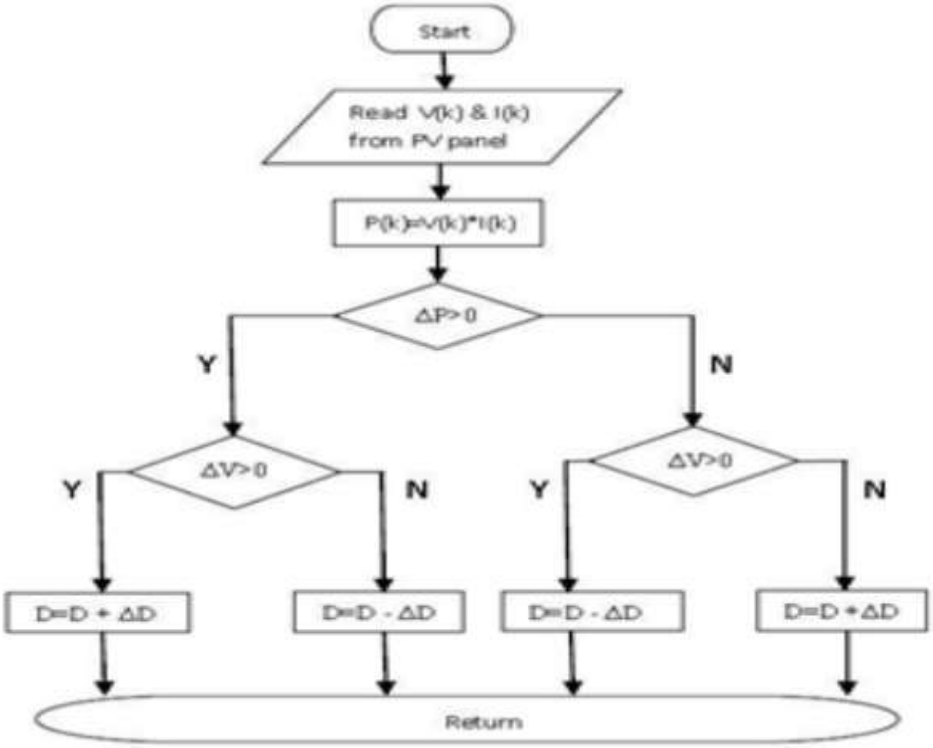

Fig. 4: Flow Chart of MPPT

A MPPT or maximum power point tracker is an electronic DC to DC converter that improves the match between the solar based group (PV panels), and the input of the inverter or utility grid. There are numerous calculation for MPPT. I utilized the power under quick differing climatic conditions however it still exceptionally mainstream and basic than some other strategy. With the goal that the state of the output is Square PWM wave. In this paper utilized this on the grounds that on the off chance that we pass this sort

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of flag in a low pass channel than we get sine wave which matches to the network.

D. DC to AC:- Inverter Here the sine wave is 50hz it is our reference flag which is appeared differently in relation to a high repeat sawtooth wave. With the objective that the output yield stat of PWM inverter is given:

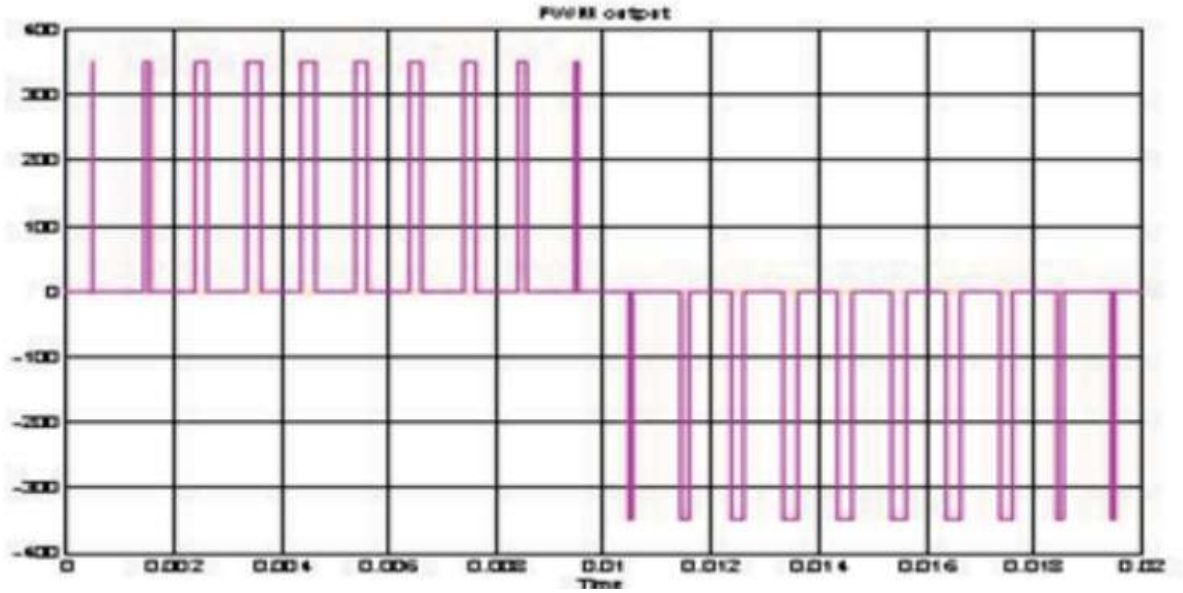

Fig. 5: PWM Inverter Output

Because of fluctuating plentifulness of the reference signal, the widths of the output of PWM inverter is changed too, realizing PWM that are regarding the adequacy of the reference flag wave. The PWM based voltage source dc to air conditioning inverter in MTALAB [simulink] shows

E. Simulation Diagram

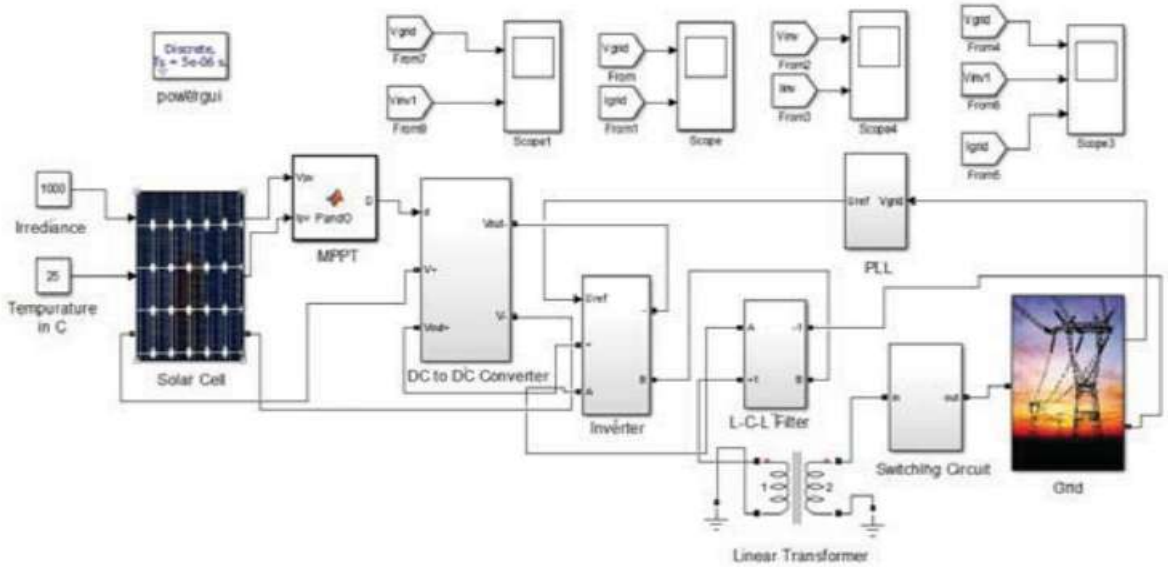

Fig. 6: Simulation of Solar Cell Inverter Synchronization with Grid

III. RESULT:-

The first waveform is of the grid and the second one is of the PWM single phase inverter, hence by looking over these waveforms we can say that they are completely in phase with each other and synchronization is achieved.

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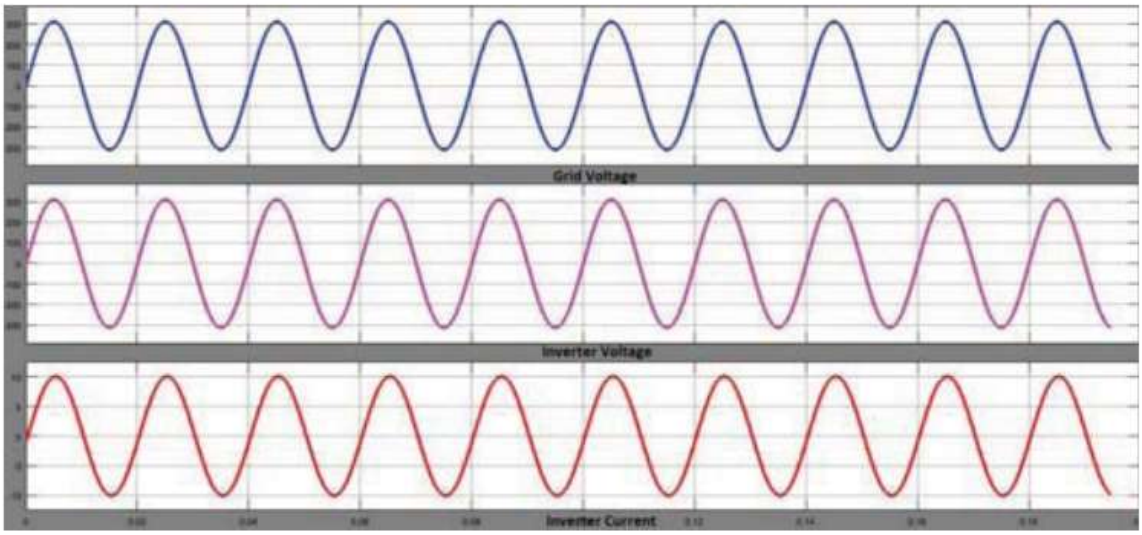

Fig. 7: Graph of Solar Cell Inverter Synchronization with Grid

IV. CONCLUSION:-

In this paper we have utilized Pulse Width Modulation based inverter. The DC voltage of the PV array is changed over to AC voltage through inverter. This AC supply is given to the residential load or grid for synchronization. It implies that the output of inverter and grid supply are in the phase with each other. This entire framework is worked utilizing solar panel.

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