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Power Inversion for Solar Electric System Based On MLIT

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***Abstract*— The project deals with five level converters by using single level grid converter. The theoretical loss of five level converters is compared with the proposed solution. The proposed converters are in the form of full bridge rectifier and consist of two switches, two diodes connected to the midpoint of DC link. The levels included by the discharge of capacitor. To balance the midpoint voltage, with a specific pulse width modulation strategy. Unipolar pulse width modulation strategy is given to full bridge topology to taken as reference. Pulse width modulation is obtained by modulating the pulse width to balance the midpoint voltage. Generally renewable source is supplied as dc power. The sinusoidal wave form is acquired. Simulation and test result gives effectiveness of the proposed result**

***Index Terms*— Boost converter, Bridge rectifier, Maximum power point tracking, Pulse width modulation, PIC-Micro controller.**

I. INTRODUCTION

S.J. Park et.al [1] has analyzed a single phase five level photovoltaic inverter topology for grid connected photovoltaic systems. Pulses with modulated signals are generated from two identical reference signals having an offset equivalent to amplitude of the triangular carrier signal. An algorithm is implemented in DSP TMS320F2812 which keeps the current in the grid sinusoidal and high dynamic performance.

R. Gonzalez et.al [3] has analyzed that novel symmetric hybrid multilevel topologies for single and three phase medium voltage high power systems. The modulation pattern of a three level switching cell with low component count gives the proposed converters. Voltage sharing and low output voltage distortion are achieved. Five level three phase topologies are generated.

Y.Zhang et.al [12] has analyzed that a novel pulse width modulation scheme with two cross carriers that controls the flying capacitor voltage by redundant switching states.

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According to the allowable fluctuation of the flying capacitor voltage and load current the capacitance of flying capacitor and switching frequency can be chosen.

The existing system requires more number of conducting devices. Also it introduces low order harmonics into the output

voltage and may break down the power switches due to fluctuation of flying capacitor voltage.

In this paper, H6 Bridge Converter structure used to obtain a five level grid connected converter for single phase applications.

II. METHODOLOGY

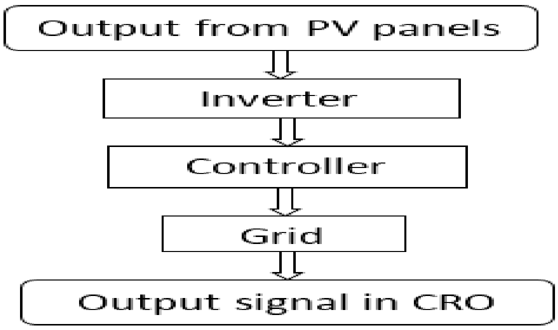

Fig.1 Organizing system

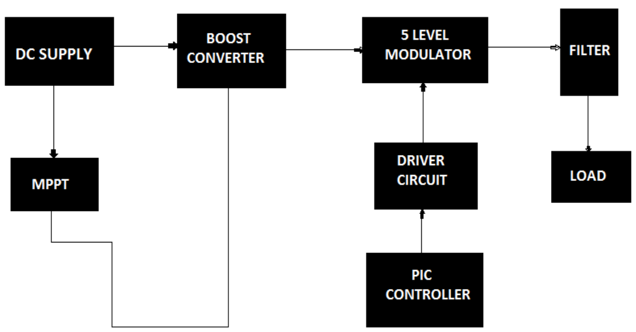

Fig.2 Functional Block Diagram

From Fig.1and Fig.2 the DC supply is given to boost converter. The boost Converter boosts the input and the output of the converter is given to multilevel inverter. The gate pulse to the inverter is given by the PIC controller.
The PIC supplies +5V. The Gate pulse from the micro controller is processed by the driver circuit. +5V is amplified to +8V by the transistor in the driver circuit and it is given to

the multilevel inverter. The output of the multilevel inverter is filtered then it is given to the load.

III. HARDWARE IMPLEMENTATION

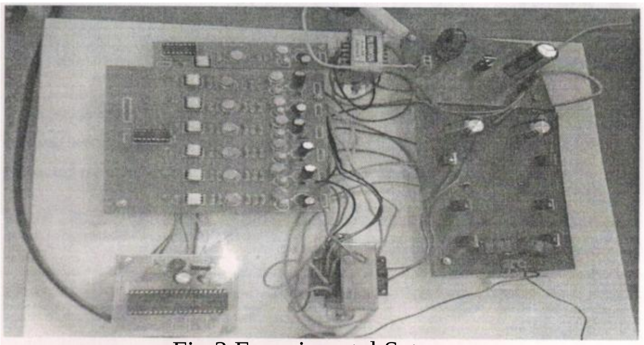

Fig.3 Experimental Setup

From figure.3 consists of diode, inductor, capacitor and MOSFET switch. The boost converter amplifies the DC input and sends to the multilevel inverter. The gate pulse is sent to the multilevel inverter through PIC controller. The pic consists of ports to increase the speed of switch then the gate pulse is sent to the driver circuit. The driver circuit consists of buffer, opto-coupler, Darlington amplifier and filter, it amplifies the gate pulse and sent to the five level inverter. It gets amplified from +5v to +12v. The signals are sent to the filter from five level converters and unwanted pulses are removed and power is supplied to the load.

A. *BOOST CONVERTER CIRCUIT*

It adjusts the operating voltage and the current to maximum level; it consists of IGBT, a diode, inductor, capacitor and resistor. Ideal switch is given as U, a combination of diode and IGBT seen in Fig.4. The operation of the boost converter depends on switch U under the continuous conduction mode. Here photovoltaic system is used the input and output voltages depends on solar irradiances. The output voltage varies with the voltage from maximum power point tracking controller to estimate the efficiency of boost converter the value of state variables are considered.

B. *OPTOCOUPLER:*

From Fig.5 It is generally used to prevent high voltages on one side to save the components. It is small in size, high speed and greater reliability.

C. *DRIVER CIRCUIT:*

Driver controls another circuit. One driver circuit controls two MOSFET. IR2110 IC is used. IR2110 is a high voltage, high speed MOSFET driver.

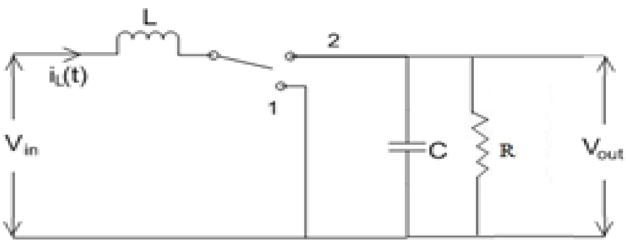

Fig.4 Boost converter circuit

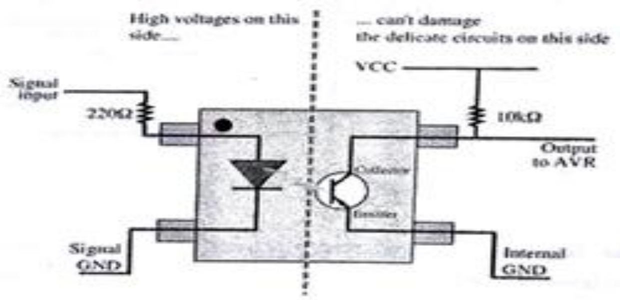

Fig.5 Optocoupler

D. *DARLINGTON AMPLIFIER:*

In this circuit shown in Fig.6 the output of one amplifier is coupled into the input of the next one by directly joining the emitter of one transistor to the base of the other.

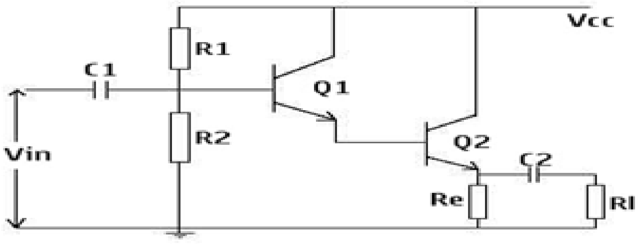

Fig.6 Darlington Amplifier

E. *BRIDGE RECTIFIER:*

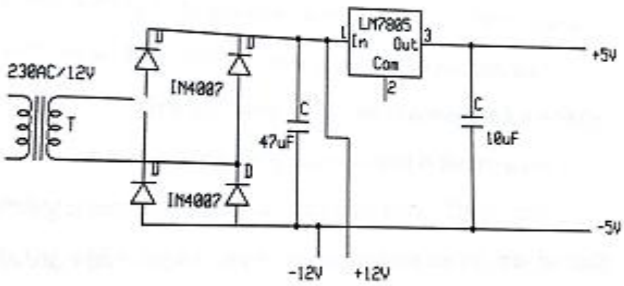

Fig.7 Bridge Rectifier

Bridge rectifier converts ac power to dc power. It consists of inductors, capacitors, diodes and voltage regulator seen in fig.7.

F. *STEP DOWN TRANSFORMER:*

The voltage is reduced from 220 v to 110v here current will be increased. Copper windings save more current than aluminum so they are used. Efficiency will be high.

G. *PIC:*

It consists of ports. Port A and the TRISA register. Port A function depends on TRISA. The TRISA controls the direction of port pins even analog inputs are used. Port B and the TRISB register where port B depends on TRISB. The mismatch condition is cleared by port B and clears flag bit RBIF. It is used for interrupt on charge feature. Port C and TRISC register where port C depends on TRISC value. Port C has peripheral functions. Port D has control bit PSPMODE.

IV. SIMULINK MODEL

The Simulink model available in Annexure-1. Five level inverter Simulink is drawn using PLECS tool box, the Simulink process is fast. The output is obtained through scope connected to inverter. The controller is connected to inverter and it generates gate pulse. The filtered output is sent to grid and the output is sinusoidal wave form. It is an easy process where the own library is added. In multilevel Inverter the step wave form is converted to smooth sinusoidal wave form.

V. RESULTS AND DISCUSSION

By using the multilevel inverter the output wave form will be stepwise but when scope is connected to grid the output will be sinusoidal waveform.

When hardware and Simulink outputs are compared they are same. Fig.8 and Fig.9 shows the hardware output waveform and Simulink waveform. Both have reduced number of distortions.

By considering harmonic distortion of current the comparisons of various structures are made. For same harmonic distortion every solution is calculated at base switching frequency. The proposed solution and other solutions will act at $2f_s$ .the proposed five level solutions as the same number of commutations as the unipolar full bridge PWM, but switching voltage is half. Every topology works with half DC voltage.

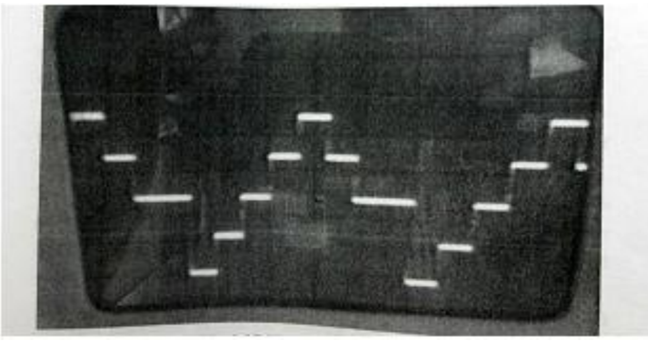

Fig.8 Digital CRO Output

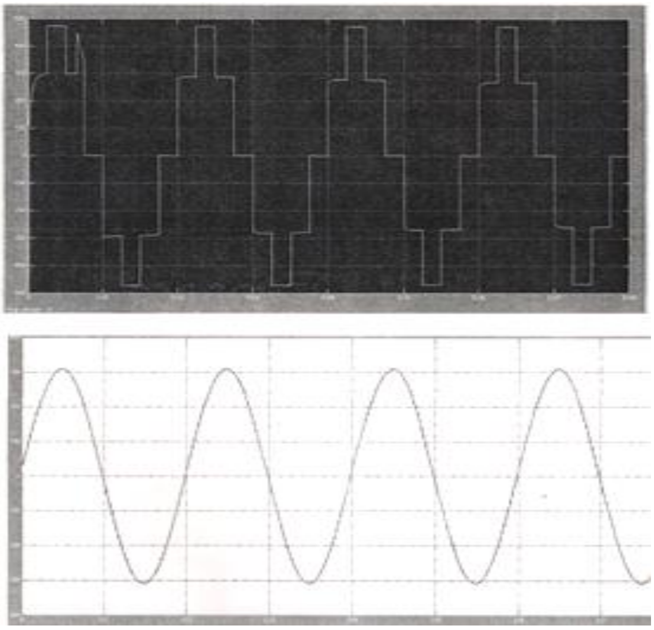

Fig.9 Simulink Output waveform when grid used.

VI. CONCLUSION

From Fig.3 deals with the output of the multilevel inverter. Generally in normal cases power factor is not unity.so there are power losses and efficiency less. There would be three output voltage level. Simulation results obtained will match the solution obtained in the CRO with the state of art. Unity power factor is important in this concept to maintain high efficiency. The PWM strategy used here uses MOSFET as active device and power loss can be reduced. Generally proposed solution can be obtained by reducing the number of switches and it is a simple technique. We can add more techniques to the multilevel inverter to obtain even more efficiency. The harmonic disturbances can be reduced. Asymmetries to be avoided to maintain the midpoint voltage. Sinusoidal wave form should be obtained.

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