Design And Implementation Of High Efficiency H6 PV Inverter With Dual Axis Tracking

C.Kalavalli, S.R.Paveethra, S.Murugesan Dr.A.Nazar Ali Dr.V.Venkatesh

Abstract: Solar energy is radiant light and heat from sun that is harnessed using PV solar panels .Due to the intermittent nature of the solar system, sunlight based gathering of solar energy means the exact centring of the solar panel onto the centroid of the sun. This paper proposes a H6 inverter with dual axis tracking which gives maximum power. Tracking is executed by sensor and special motors which are controlled by a microcontroller (PIC16F887A).The use of H6 inverter eliminates the common mode error and efficiency is increased. The proposed method is simulated and hardware is implemented.

Index terms: tracking, H6 Inverter, Boost converter, MPPT

1 INTRODUCTION

Today in the time of current science and innovation, our financial improvement depends much on electric energy. A enormous energy is provided by non-conventional energy sources such as solar, wind, gas, biomass, water and so on. In any case, the most utilized is the solar energy. Since 1hour of daylight dropping on the earth periphery is indistinguishable with the absolute energy we utilize the entire year universally[1-2]. This solar energy is being famous in light of its non-defiled property. The solar energy is converted into electrical energy by photo-voltaic conversion. Solar panels captures the solar irradiance. But solar tracker is more efficient than the panel, because it senses the revolving of the earth and rotates by its axes following the sun to get the complete radiation and the efficiency is maximised. Solar energy reaches on earth in form of different rays which some are visible and some (such as x-rays) cannot be seen. Only a small energy reaches the earth though the lot of energy is transmitted from the sun every day. Because most of the energy is lost in the atmosphere. Though this energy is very small we use this energy in our life every day. It is clean and free to all and we will never face the scarcity of solar energy like any other energy.

2 SOLAR TRACKER

Solar tracker tracks the position of the sun as it rotates from east to west during daytime. It is classified into I) Single axis tracker and ii) Dual axis tracker. In our proposed model a microcontroller-based tracker is used.The dual axis tracker turns the board in such a position where the board will be opposite to the sun i.e the edge of occurrence of sun shaft will be 0°. Light dependant resistors (LDR) are utilized for detecting the positional difference in the sun. This sensor ceaselessly screens the sun powered radiation and this information are moved to the stepper motor through microcontroller.

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The stepper motor moves the board where the power of light is greatest. Our point is to limit the power utilization and expand the energy generation. A Dc-Dc Converters with Coupled inductors can gives high output voltage with low duty cycle and which reduce the switching stress[3-6]. However, they have large input current ripple and are not suitable for high power applications since the capacity of the magnetic core is considerable[7-8].

3 H6 INVERTER

A high-effectiveness single-stage transformer-less H6 Inverter is projected. The hybrid modulation technique has advantages of both bipolar and unipolar modulation[9-11]. It comprises of six MOSFET switches. There are four distinct modes in H6 inverter.

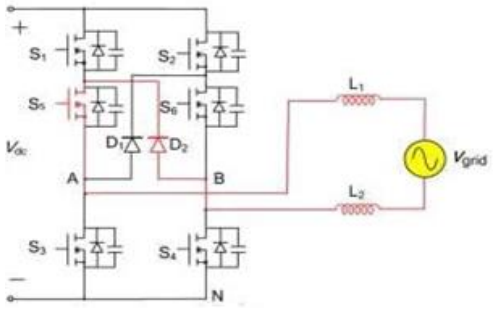

Fig.1 *H6 Inverter*

Mode 1:

In the network +ve half-cycle, S_5 is consistently ON, where S_1 & S_4 are dynamic. The input voltage applied to L1 and L2 is the difference between the input and load voltage.

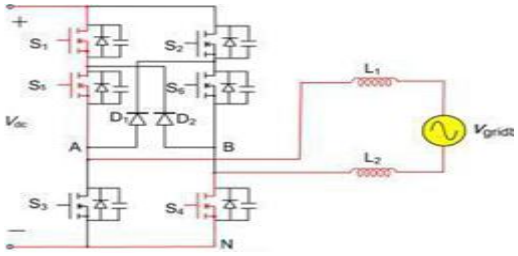

Fig.2 *H6 Inverter under mode 1*

Mode 2:
In the network +ve half-cycle, S_5 is still ON, where S_1 & S_4 gets inactive. Moreover, D2 commutates at the PWM switching frequency.

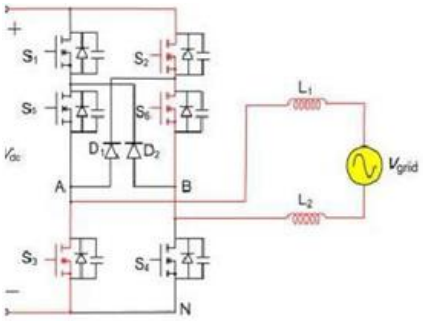

Fig.3 *H6 Inverter under mode 2*

At this time, the input voltage flow from parasitic capacitors to switches S1 and S3 because the large impedance of inactive switches blocks the discharging of parasitic capacitors.

Mode 3
In negative half-cycle where VDM changes in between 0 and−Vdc/2, due to Modes 1–4 , CM voltage is denoted as VCM is almost constant value of half input voltage Vdc/2. Therefore the H6 inverter with hybrid modulation technique has a high performance in Common Mode noise elimination. A split dc link is not required with a use of parasitic capacitor.

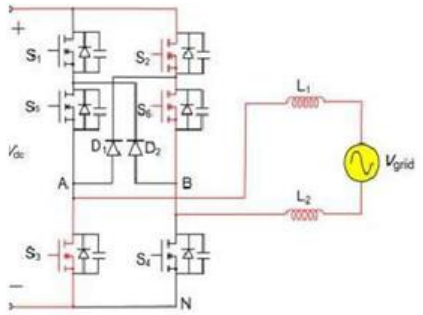

Fig.4 *H6 Inverter under mode 3*

Mode 4

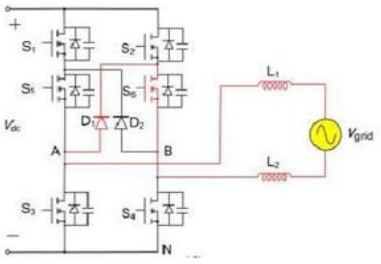

Fig.5 *H6 Inverter under mode 4*

4 PWM FOR INVERTER

The bipolar sinusoidal PWM is used for switching the MOSFET.

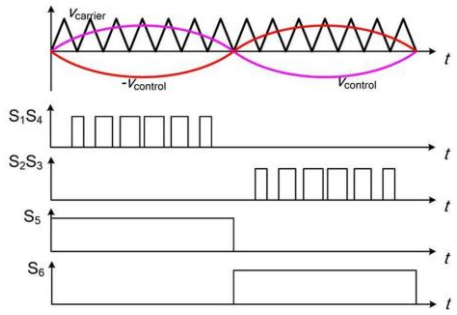

Fig.5 *PWM pulses for switches*

5 BOOST CONVERTER

A boost converter is a DC_DC power converters, with the output voltage is always greater than the input voltage. DC_DC converters have a wide range of uses today. It is the DC equivalent of the transformer. Filter capacitors are used to reduce the ripple from the output voltage. It consists of Switched More Power Supply unit[12-18].

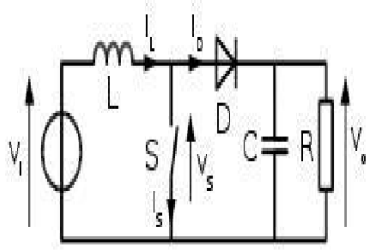

Fig.6 *Boost converter*

Mode 1:
At the point when switch (S) is shut the present courses through the inductor clockwise way. Henceforth the extremity of the inductor is certain

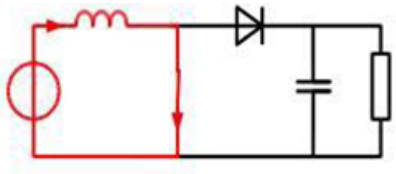

Fig.7 *Boost converter under mode1*

Mode 2:
At the point when switch (s) is open, current is decreased as the impedance is higher. Consequently a change or decrease of current will restricted by the inductor. Henceforth the extremity of the inductor will be turned around.

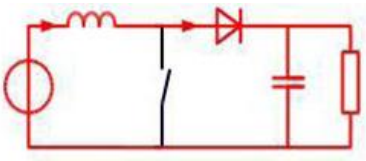

Fig.8 *Boost converter under mode 2*

6 PO ALGORITHM

A MPPT calculation used to remove the more power from sun oriented board and power is given to stack. DC-Dc converter is utilized with PO calculation for creating more capacity to stack[19-20].

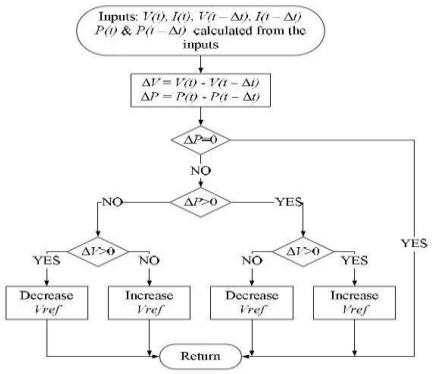

Fig.9 *Flow chart*

7 LIGHT DEPENDENT RESISTOR

Light-dependent resistor (LDR) is a light-controlled variable resistor in which resistance decreases with increasing incident light intensity based on photoconductivity principle.

8 STEPPER MOTOR DRIVER

Steppers drivers gives high revolution speeds in stepper motor by utilizing a microcontroller. Microcontroller controls precisely empowerment of every individual coil inside the motor. It is important to get high speeds, because as speed increases, timing of the coil firing is synchronized. The H-bridge connections are utilized for controlling the power that energies to every individual loop on the stepper motor. Hence, for bipolar stepper motor, two chips are required[21-24].

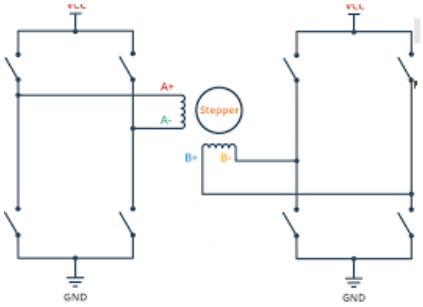

Fig.10 *H bridge stepper motor*

9 SIMULATION DIAGRAM

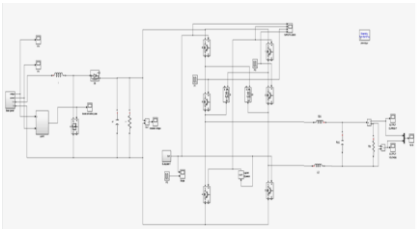

Fig.11 *Simulink diagram for H6 inverter*

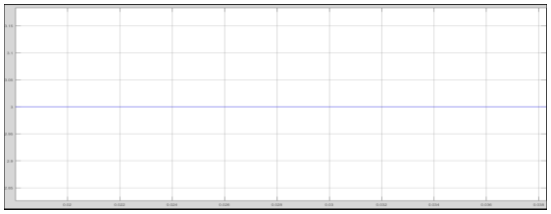

Fig.12 *Output from solar panel*

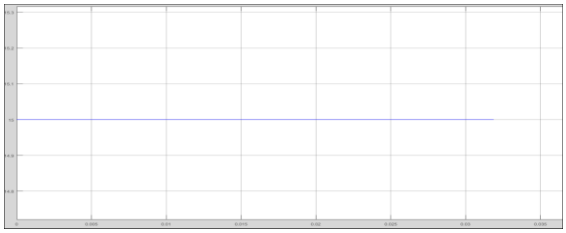

Fig.13 *Output from Boost converter*

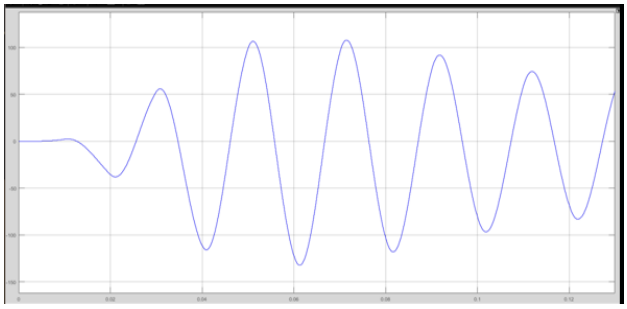

Fig.14 *Output from H6 Inverter*

10 EXPERIMENTAL SETUP

11 CONCLUSION

This paper designed a new dual axis tracking system with help of H6 inverter for getting maximum power. The experimental setup shown in the range 10W and 12V PV panel the same can be implemented using MATLAB tools. In the proposed H6, output current and voltage ripple can be

significantly reduced and it improve efficiency 35-40 when compared to the other system.

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