A Novel High Efficiency Interleaved Solar Micro-Inverter

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Abstract- *Analyzing design and implementation of interleaved solar micro-inverter which have a better efficiency to extract the Maximum output voltage. In a solar is an input which is given to the flyback inverter and the output of the inverter gets overshoot ripple voltage. So we need to rectify the ripple and introduce the snubber capacitor to reduces the voltage spike and to improve the efficiency of the system. And also include the increased level of multistage inverter topologies is to extract the maximum voltage without ripple, total harmonic distortion. Here we use three cell interleaved flyback inverter. The maximum efficiency will achieve upto 94%*

Keywords- Harmonics, Flyback converter ,interleaved converter, micro-inverter, photovoltaic inverters.

I. INTRODUCTION

Solar is the most important renewable and freely available energy in the world. The Research and Development in solar energy is rising till now in the world. The main objective of this paper is to improving the efficiency of solar with a flyback inverter to introduces the snubber capacitor to reduces the peak voltage. the flyback converter is a simple circuit structure and easy power flow with better power quality. The flyback converter is recognized as the lowest cost of converter among the isolated topology. since it uses the minimum number of components. The advantage comes from the ability of the flyback topology combines the energy storage in inductor with the transformer. In an another type of interleaved topology, the energy storage inductor and the transformers are separate elements. While the inductors are responsible for energy storage, the transformer are responsible for energy transfer over a galvanic isolation. The combination of the two components in a flyback conversion topology eliminates the bulky and costly energy storage inductor and therefore leads to reduction in size of the converter and cost. However, the cost depends on the implementation as much as the selected conversion topology, so not every implementation of the flyback topologies leads to a low-cost converter. The magnetizing inductance of tansformer is going to be quite small. Therefore the mentioned challenge is actually achieving such as small magnetizing inductance Lm with low leakage inductance Ll. A flyback converter built with a transformer, which has large leakage flux and poor coupling will have poor energy transfer efficiency. The above main reason, generally the flyback converters are not designed for high power. As a result, the flyback conversion topology finds a limited role in photovoltaic (PV) applications only at very low power as microinverter. In this technology every photovoltaic panels are connected with a micro inverter. Many photovoltaic panels are connected in parallel to get expected power output. The maximum power harvesting of solar energy in this method is better since this is dedicated to maximum power point tracking (MPPT) for every panel.

The ability of converter is to reduces the size of passive component is beneficial for reducing the cost and to obtain a compact converter. Fig. 1 shows the block diagram of the proposed grid connected interleaved flyback converter topology based PV inverter system. The result of an earlier work based on the same topology where the primary objectives is to prove the concept with a design at 2 kW were presented. Since the time of that work, there have been major design change and upgrades In order to process double the times more power and at the same to achieve better performance of the system.

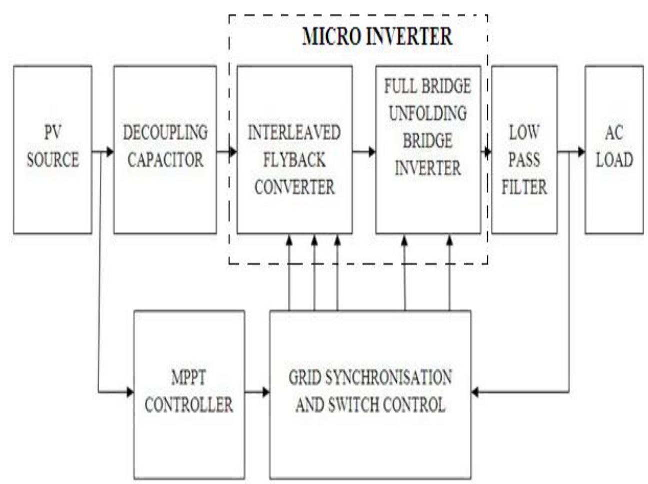

Fig 1. Block diagram of the proposed grid connected interleaved flyback converter topology based PV inverter system

II. CONVERTER DESCRIPTION

The PV source is applied to the three cell flyback micro inverter with decoupling capacitor. In this converter we use a switch as MOSFET for switching the primary side, transformer, diode as secondary side and filter. When the switch is ON, current flows from pv source to magnetizing inductance of the flyback transformer.during the ON time of the switch ,there is no current flow to the output due to the secondary side diode.energy to the grid through the filter capacitor Cf and inductor Lf. When the flyback switch is OFF the stored energy in the magnetizing inductance is transferred to grid. So the flyback converter acts as voltage controlled current source.

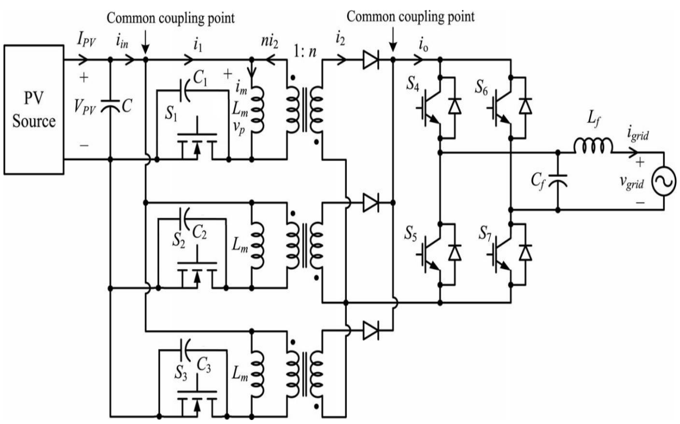

Fig 2. Circuit diagram of the proposed PV inverter system based on three-cell interleaved flyback converter topology

III. CONVERTER DESIGN

Since the design is for small electric power system for all residential applications.Table I gives the complete specification of all the components using inthe circuit. The switching frequency (fs) is selected as 50 kHz is to achieve high efficiency with smaller sized magnetics. In DCM operation, the turn ON switching losses are eliminated since the current starts from zero at every switching cycle, which is an important advantage, but in return the switch itself will face large peak current stress and associated high turn-off switching losses.

Due to the fact that the MOSFETs with low voltage ratings have much lower ON-state resistance and more efficient as far as the conduction losses are concerned, we prefer Low voltage design.

This number is selected as three based on the following strategies.

The major aim of interleaving is to reduce the passive filtering efforts to the practical minimum. Support to the phase-shifted operation, the ripple (harmonic) magnitude can be reduced while the ripple frequency is to be increased simultaneously. The number of cell increases, but the number of component goes up. So, a compromise between the benefit obtained due to the reduced size and cost of the LC filters and the disadvantage due to the increased component count must be made

Table I: Design Specification

Design Parameter	Specification
PV model and maximum power	BP365, 65 W
Input voltage	24 V
Switching frequency	50 kHz
Number of interleaved cells	3
output voltage	230 V

To determine the ideal power rating for single stack flyback inverter ,it is not practical to design at 2 kw power at high switching frequency. The efficiency of the system concerns that the upper ratings. The minimum number of cells connected to the parallel to reach 2kw. So this achievement will reduce the number of cells to achieve 750w. The main modifications for flyback converter design at 750w is better performance.

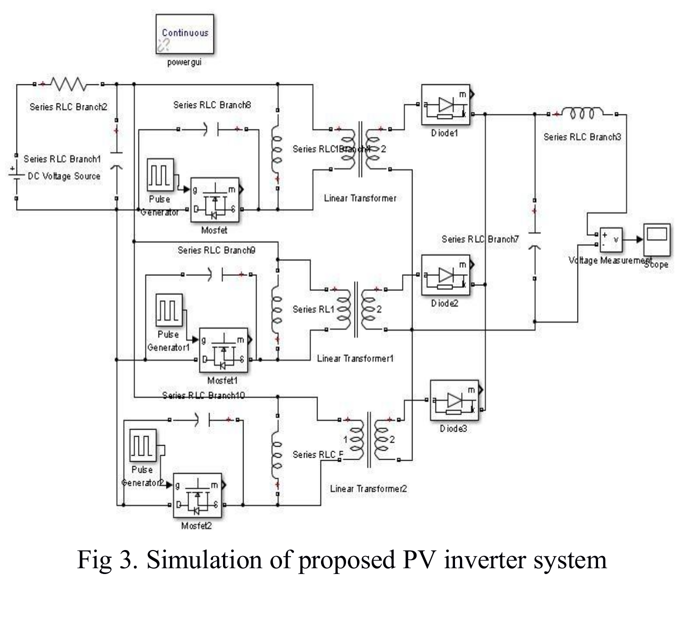

Fig 3. Simulation of proposed PV inverter system

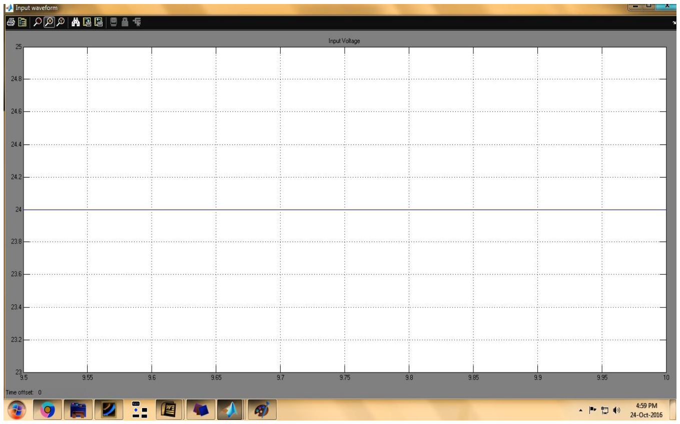

Fig 4. Simulation of input voltage waveform

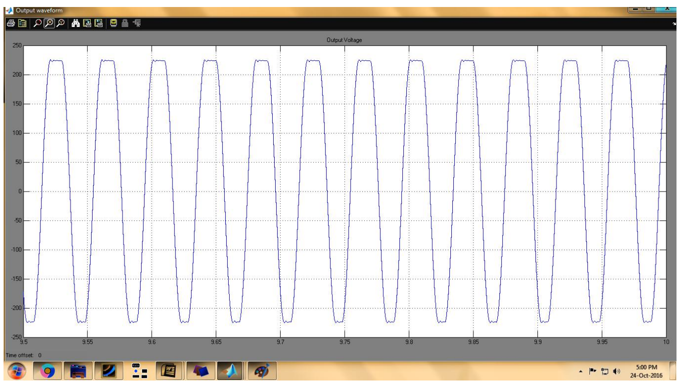

Fig 5. Simulation output voltage waveform

IV. CONCLUSION

A Normal inverter for power systems applications rated 2kW is experimentally verified based on the interleaved flyback topology which is 700W each cell. Here we use three cell flyback inverter is designed and the output voltage has been verified successfully.

And also reduced the total harmonic distortion and also improve the efficiency.the performance of our new system is simulated in matlab simulation and the output is shown above the figure.further more the proposed system is cost effective compared with efficiency.

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