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Design and Implementation of High Gain DC-AC Converter for Micro Power Generation

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ABSTRACT: As the photovoltaic power generation application becomes universal worldwide, it is increasingly important to improve the overall energy conversion efficiency. To improve overall energy conversion efficiency, this project we are using DC/AC hybrid boost converter. This proposed system having two stage, they are DC-DC boost conversion and DC-AC conversion. single switch , single inductor with multiple capacitor is proposed by using in DC-DC conversion . Compared with the other converter the proposed DC-DC converter has smaller output ripple and higher components utilization rate with respect to conversion ratio. The proposed topology has achieved smaller ripple with single switch and single inductor while maintaining high voltage gain.T-Type five level inverter topology is used to convert DC-AC conversion. Five-level topology has more voltage stages, smaller harmonic, smaller filter inductance, and less power network pollution. However, the conventional five-level inverter contains too many switching devices. It not only has large power loss and low efficiency, but makes it more difficult to achieve neutral-point balance and control as well. Therefore, this topology is rarely used in industry. Instead, many topologies in the literature have been studied to optimise the performance, such as to reduce the total harmonic distortion , the number of devices, the power losses , and to balance the capacitor voltage etc.

Reduced rating hardware model will develop to validate the proposed system. Arduino Uno controller is used for develop the firing pulses. IC TLP250 is used for driving the MOSFETIRF5

I. INTRODUCTION

Widespread use of power supplies in most electrical equipment rationalizes the reduction of its cost and volume. Increasing switching frequency is the most effective way to reduce the volume of power supplies. In medium power applications where isolation is required, flyback and forward converters are preferred for their simplicity and cost effectiveness. These topologies are usually employed for output powers less than 200W.The absence of output inductor in flyback converters results in better voltage regulation for multioutput power supplies. Also, due to the absence of output inductor, multi outputs can be implemented at lower cost and volume. The main disadvantage of flyback converters is the energy stored in transformer magnetizing inductance that would result in the larger transformer. For better stability, it is desired to design the flyback converter in discontinuous conduction mode (DCM) that results in higher transformer core losses due to large flux swing. This problem does not exist in the forward converter but it requires an output inductor and consequently higher cost and lower cross regulations are imposed.

To improve the regulation of multiple output forward converters, some topologies are presented in and that require additional switches and accordingly results in increased cost and converter volume. Generally, it is desired to increase the switching frequency in order to reduce the volume of power supplies. However, at high switching frequencies, switching losses, and electromagnetic interferences increase. To avoid these disadvantages, soft- switching techniques are employed. Soft-switching techniques fall into two categories of constant switching frequency and variable frequency converters.

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II. LITERATURE REVIEW

2.1 Modified SEPIC DC-to-DC boost converter with high output-gain configuration for renewable applications-Charles Muranda-Emre Ozsoy-Sanjeevikumar Padmanaban-2017

This paper articulates the novel topology for modified SEPIC converter and much suitable for renewable energy and high-voltage applications. Power circuit incorporated with one additional inductor and capacitor to the classical SEPIC converter as a voltage lift component. Hence, it overcomes the effect of parasitic effects of the circuit components (MOSFET/passive elements).

2.2 High voltage-gain interleaved boost DC-DC converter with reduced capacitance requirement-Breno B. Chaves, Mateus P. Vieira and Francisco J. B. Brito-2017

This work proposes a high voltage gain DC-DC step-up converter that provides reduction of the capacitance requirements for the dc-link, which allows the replacement of electrolytic capacitors by film capacitors that have a longer lifetime. The topology is an interleaved converter based on the three-state switching cell, in which the output to input voltage ratio can be raised by adding an auxiliary winding to the transformer

2.3 A novel non-isolated high-gain dc-dc boost converter-Ahmad Alzahrani-Pourya Shamsi-Mehdi Ferdowsi-2017

In this paper, a novel interleaved boost converter topology is introduced. The proposed converter is based on a combination of two types of voltage multiplier cells (VMC): Dickson and Cockroft-Walton (CW) voltage multiplier. Connecting VMCs to an interleaved boost stage yields many benefits, including smaller ripples on the input current, reduced voltage stress across switches and capacitors, and high overall voltage gain. These advantages allow designers to design high gain dc-dc converters with low-rated and highly efficient semiconductor components.

2.4 Generalized High Step-Up DC-DC Boost-Based Converter With Gain Cell-Lenon Schmitz, Denizar C. Martins and Roberto F. Coelh-2016

High step-up conversion is an indispensable feature for the power processing of low voltage renewable sources in grid-connected systems. Motivated by this necessity, this paper presents a study on non-isolated dc-dc converters based on the conventional Boost converter that can provide such feature with high efficiency.

2.5 A Novel Hybrid Five-Level Voltage-Source Converter Based on T-Type Topology for High-Efficiency Applications-Shuai Xu, Jianzhong Zhang and Xing Hu-2017

A novel hybrid five-level voltage-source converter for high-efficiency applications is investigated in this paper. Compared with traditional multilevel converters, this hybrid multilevel converter generates desired staircase voltage levels with a reduced number of power devices and isolated drivers at higher voltage levels. It has redundant switching state combinations in hybrid multilevel converter, which makes it easy to balance flying capacitor voltages and realize fault-tolerant operation.

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1.1 Block Diagram of Proposed converter

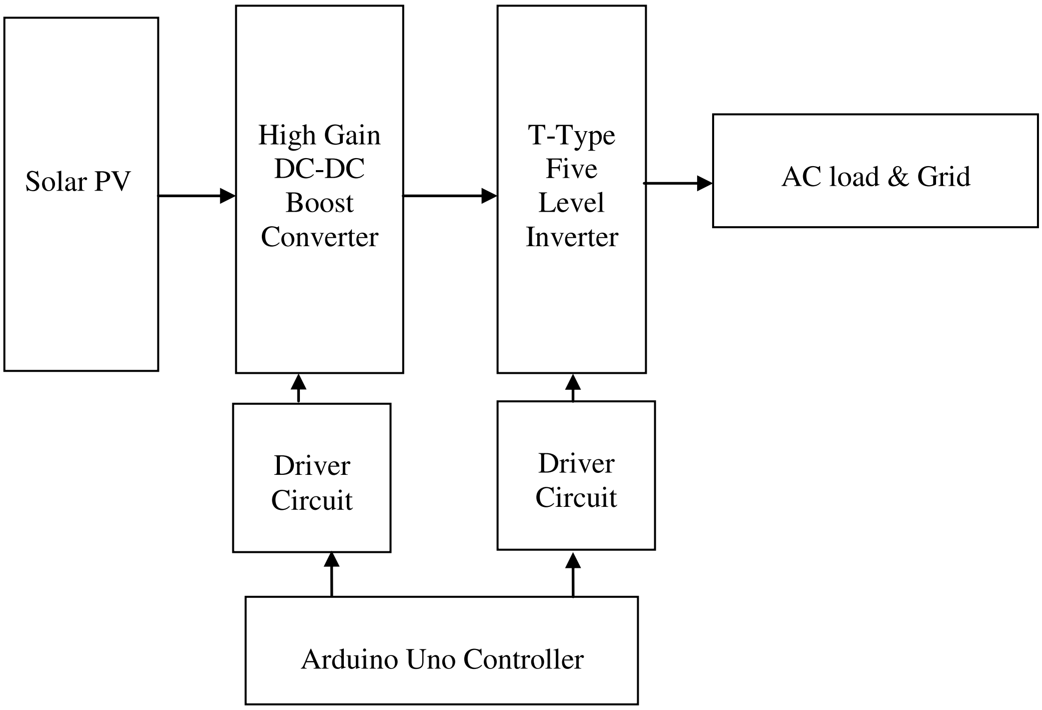

Fig 1.1 Block Diagram of Proposed converter

1.2 Block Diagram of Existing System

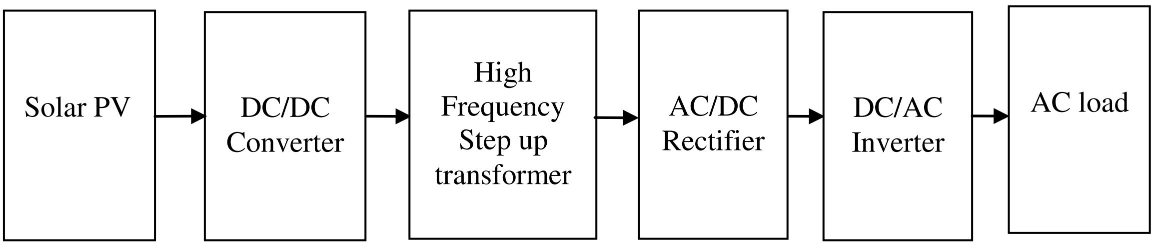

Fig 1.2 Block Diagram of Proposed converter

III. DC-AC TOPOLOGIES

This chapter is a literature review which presents the state-of-art of the different multilevel inverter topologies system research better. Although there are a large number of multilevel inverter topologies in the literature, in this chapter only the most common topologies are reviewed. The detailed advantages and disadvantages of these multilevel inverter topologies are discussed in this chapter. Also, the Details on the impact of unbalanced load/source on multilevel inverter are explained.

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3.1 TOPOLOGY OF MULTILEVEL INVERTERS

Multilevel inverters have an arrangement of power switching devices and capacitor voltage sources. Multilevel inverters are suitable for high-voltage applications because of their ability to synthesize output voltage waveforms with a better harmonic spectrum and attain higher voltages with a limited maximum device rating. There are three main types of multilevel inverters: diode-clamped (neutral-clamped), capacitor-clamped (flying capacitors), and cascaded H-bridge inverter.

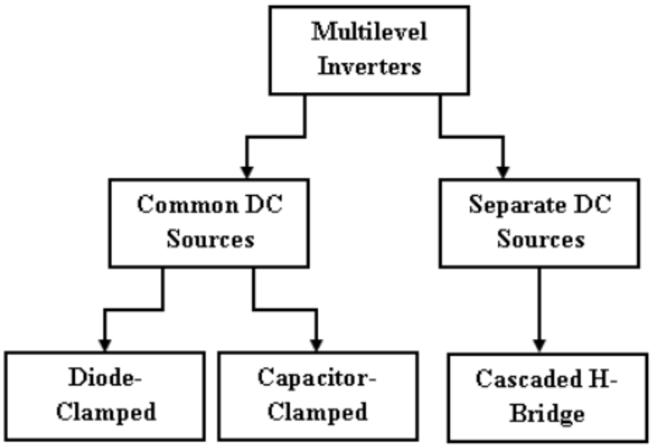

Fig:3.1 Multilevel Inverter Topologies

DC-DC AND DC-AC CONVERTERS

Proposed converter is introduced and its operating modes are discussed. The proposed converter and its equivalent circuit are shown in Fig. 2.1(a) and 2.1(b).

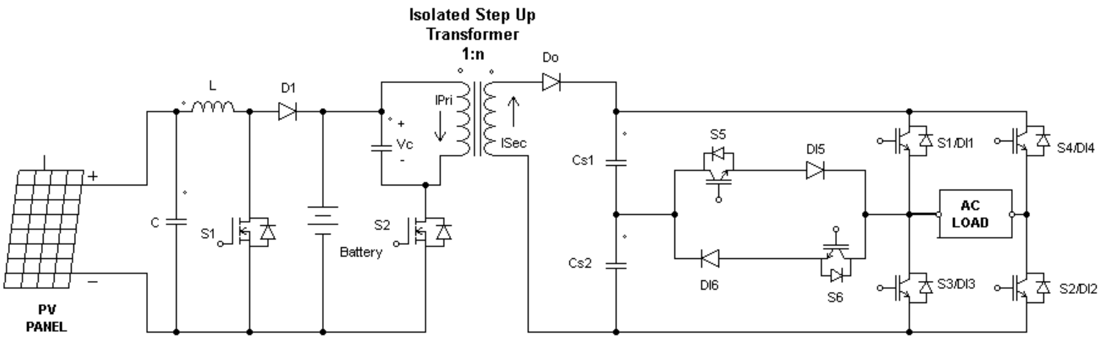

Fig.4.1 DC to DC and DC to AC converter

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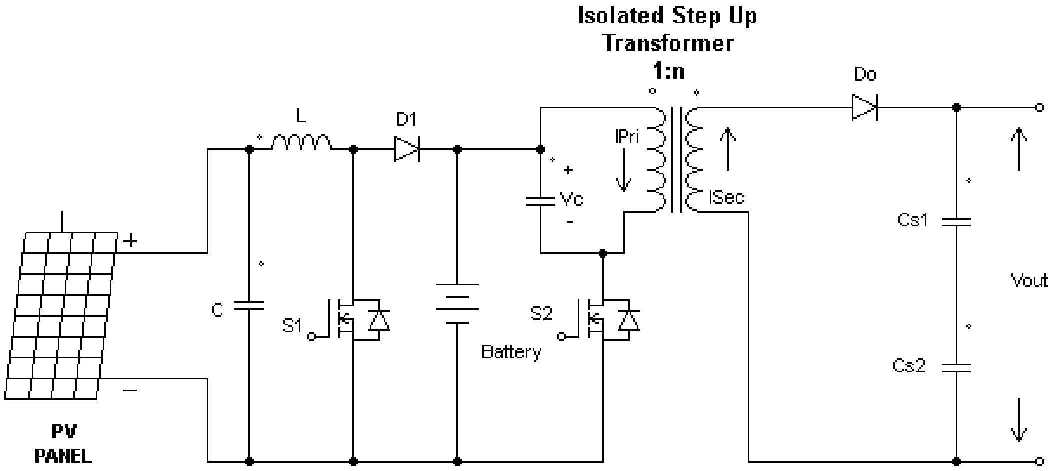

Fig.4.2 DC to DC converter

4.2 DC to DC converter

DC-DC converter Switch S2 is ON

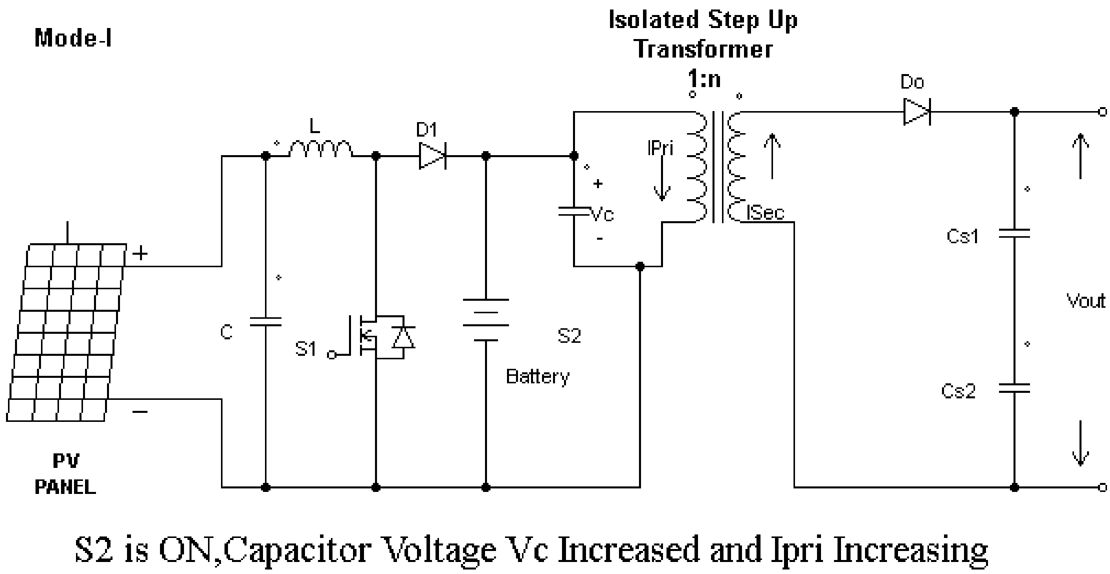

Fig.4.3 DC to DC converter

V. MATLAB SIMULATION

Computer models of electric machines leading to the assessment of the dynamic performance of open- and closed-loop ac and dc drives. The Simulink/MATLAB implementation is adopted because of its inherent integration of vectorized system representations in block diagram form, of numerical analysis methods, of graphical portrayal of time evolutions of signals combined with the simple implementation of the functionality of controllers and power electronic excitations.

The development of Simulink models of drive assemblies is a relatively simple task consisting of combining input output block representation of the various components making up the system.

This approach provides a powerful design tool because of the ease of observing the effects of parameter modifications and of changes in system configurations and control strategies. Under the rubric Animations, a series of movie clips portrays the motion of electric machines, magnetic fields, and space vectors.

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MATLAB SIMULATION DIAGRAM

DC-DC Converter

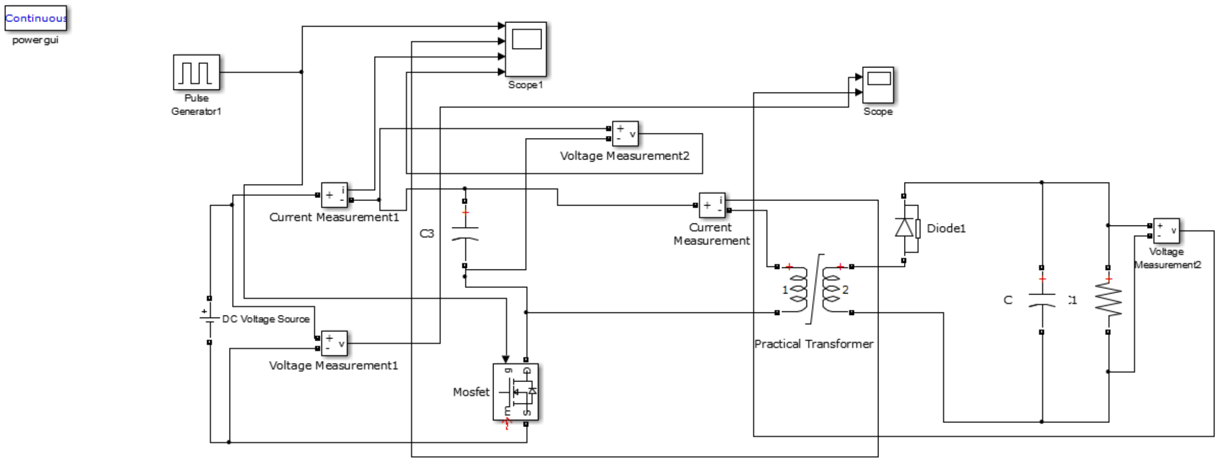

Fig 4.11 Boost Converter Simulation Diagram

DC –DC converter Simulation Result

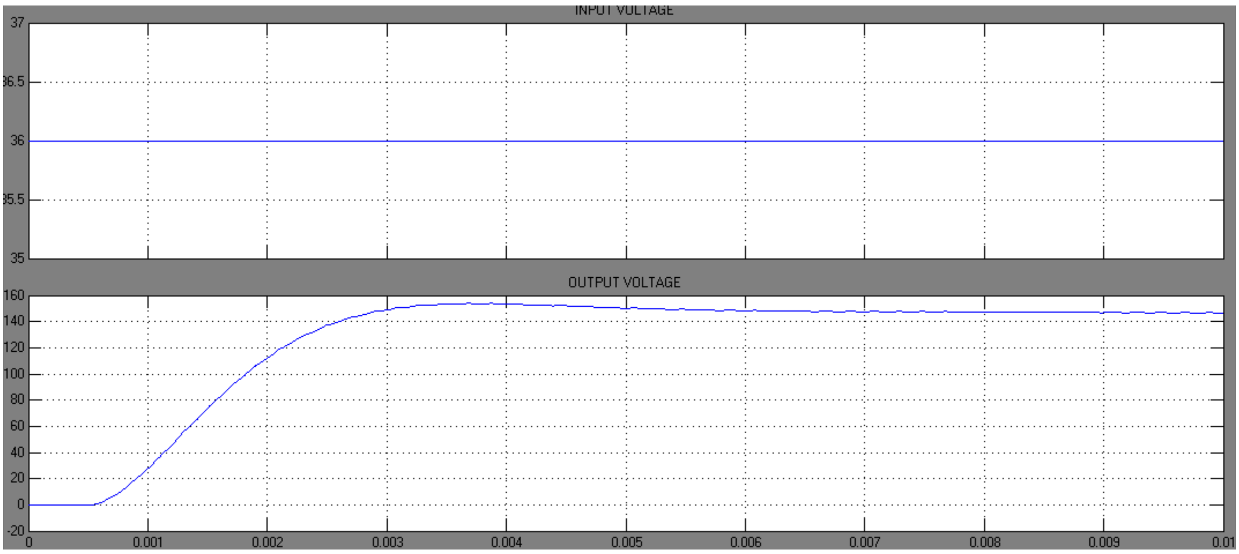

Fig 4.12 Input and Output Voltages (vs) Time

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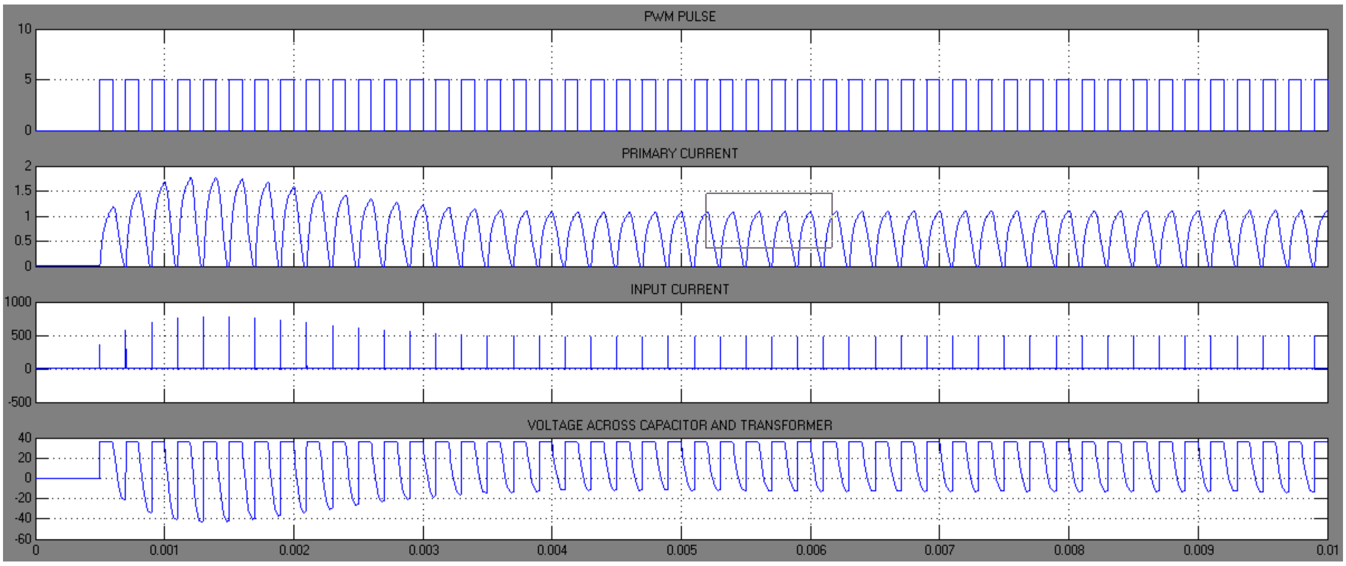

Fig 4.13 PWM Pulses,Primary Current,Input Current and Voltage across Capacitor and Inductor (vs) Time

FIVE LEVEL INVERTER

5.3 MATLAB SIMULATION MODEL

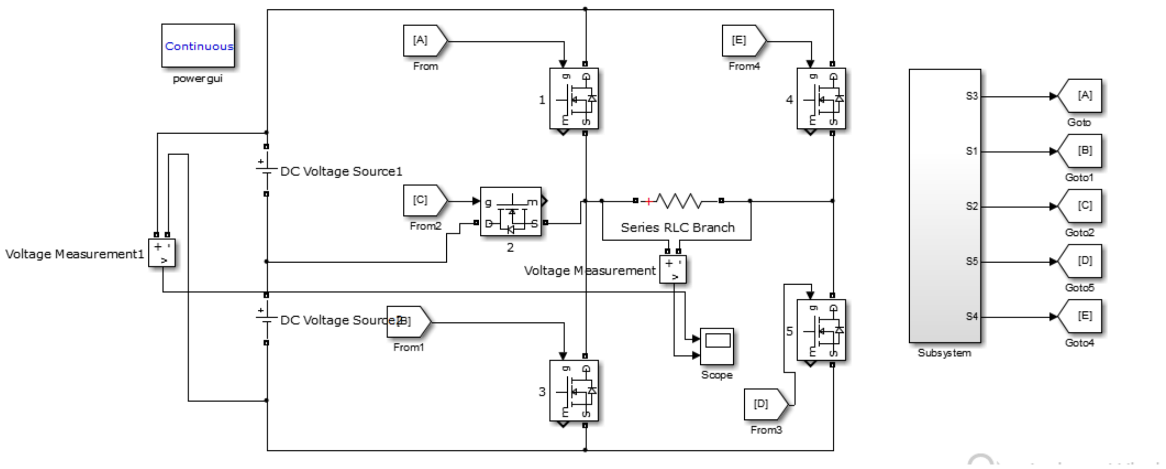

Fig.4.14 MATLAB Simulation Model of Five Level Inverter

5.4 MATLAB SIMULATION RESULT

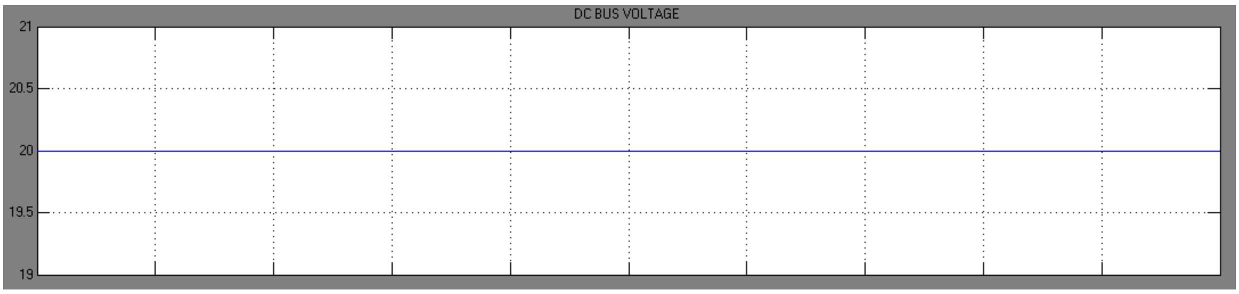

Fig4.14 :Input Voltage

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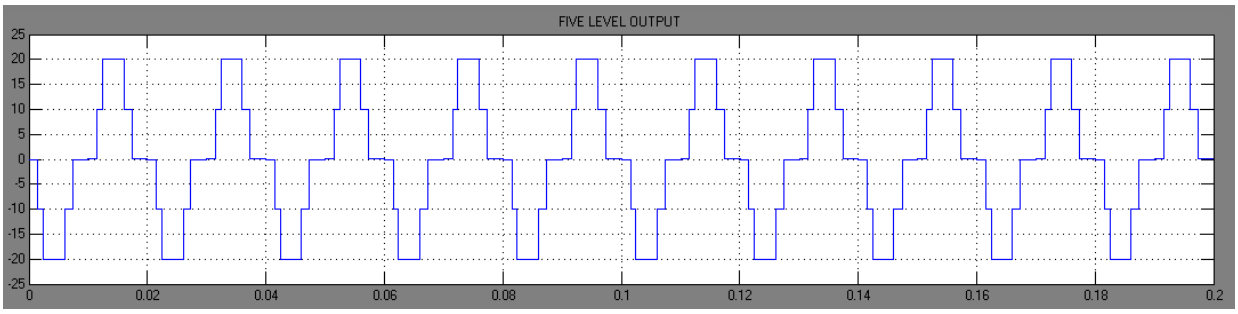


Fig 4.15 Voltage across Load

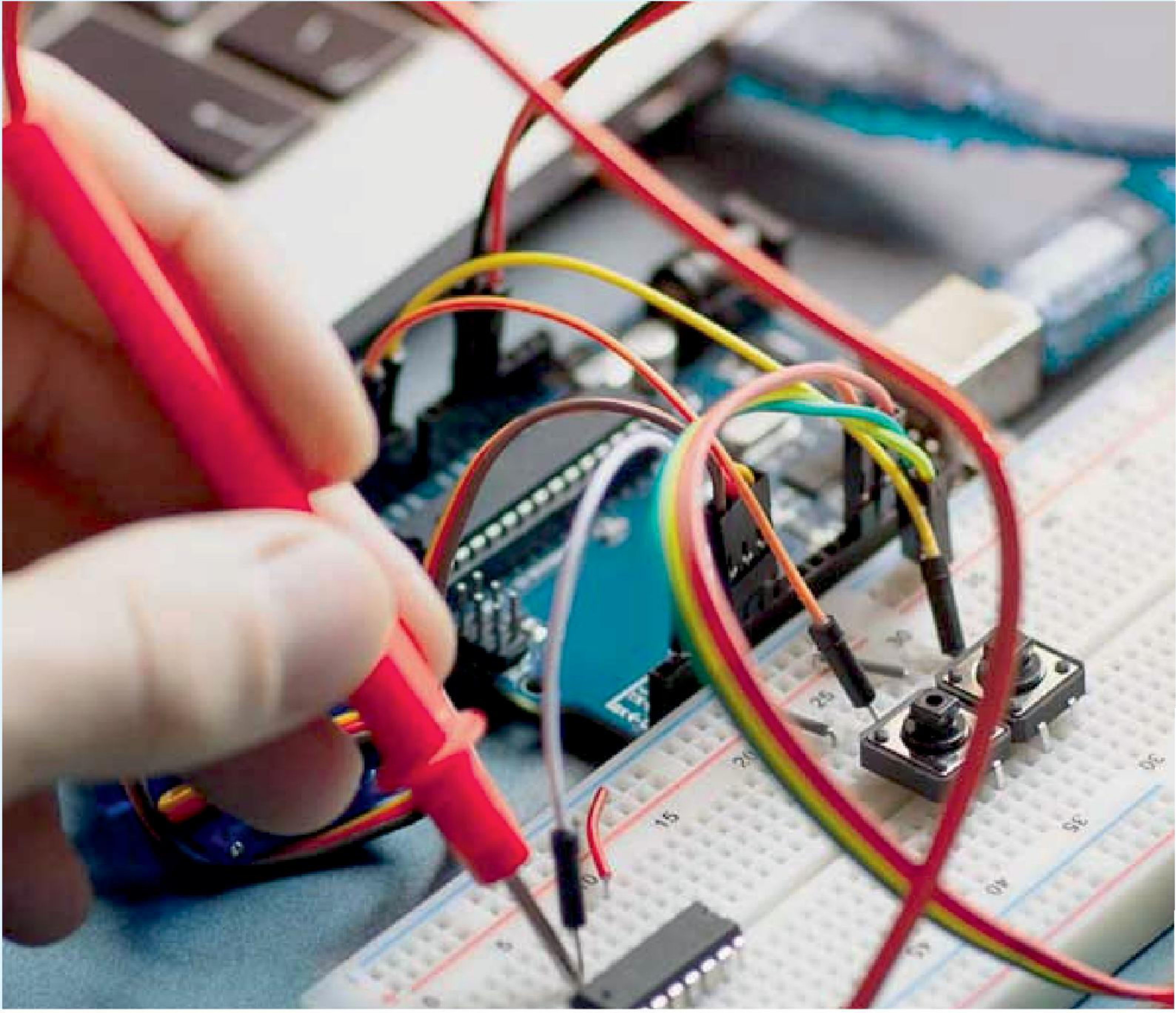
VI. CONCLUSION AND FUTURE WORK

A new single switch soft-switching isolated converter is introduced. The operation of the proposed converter is similar to a flyback converter. However, in the proposed converter, a capacitor is involved in transferring energy instead of transformer magnetizing inductor that results in reduction of transformer size and weight. Also, transformer leakage inductance energy is transferred to the load. Thus, the introduced converter is an appropriate choice for implementation of low cost PV converter system.

The output of proposed DC-DC converter is fed to 5-level T-Type-MSSC inverter. The main advantages observed in the proposed inverter are: the reduced total losses on semiconductors devices, resulting in good efficiency (above of 96%) when compared with other multilevel inverters topologies; the presence of the five levels in the output voltage before the filter, providing lower content harmonic; and reduced volume and weight of the magnetic components, reducing cost and volume of the inverter.

REFERENCES

1. E. Adib and H. Farzanehfard, “Analysis and design of zero current switching forward converter with simple auxiliary circuit,”IEEE Trans. PowerElectron., vol. 27, no. 1, pp. 144–150, 2018.
2. R. P. T. Bascopé,J. A. F. Neto and G. V. T. Bascopé, “Multi-state Commutation Cells to Increase Current Capacity of Multi-Level Inverters”, presented at the Telecommunications Energy Conference (INTELEC), Amsterdam, Netherlands, 2016.
3. E. Adib and H. Farzanehfard, “Analysis and design of zero current switching forward converter with simple auxiliary circuit,”IEEE Trans. PowerElectron., vol. 27, no. 1, pp. 144–150, 2017.
4. L. Hang, S. Wang, S. Liu, Y. Gu, W. Yao, and Z. Lu, “High cross regulation multi-output LLC series resonant converter with magamp postregulator,” IEEE Trans. Ind. Electron., vol. 58, no. 9, pp. 3905–3913, Sep. 2016.
5. M. Borage, S. Tiwari, and S. Kotaiah, “LCL-T resonant converter with clamp diodes: A novel constant-current power supply with inherent constant-voltage limit,”IEEE Trans. Ind. Electron., vol. 54, no. 2, pp. 741–746, Apr. 2015.
6. Z. Qian, O. Abdel-Rahman, and I. Batarseh, “An Integrated four-port dc/dc converter for renewable energy application,” IEEE Trans. Power Electronics, vol. 25, no. 7, pp. 1877-1887, July 2017.



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