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Cascaded H-Bridge Multilevel Inverter Topology with High Frequency Galvanic Isolation for Grid Connected PV System

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Abstract —*Cascaded H-bridge multilevel inverter is a dynamic solution for grid connected PV system. Due to separate DC link feature DC sources can be replaced by PV module/panel and more precisely voltage is controlled. This can be achieved by introducing maximum power point tracking (MPPT) in each module .the total power extracted from PV panels will be maximized and hence the efficiency improves. This paper consist of single phase cascaded H-bridge MLI topology is proposed for grid connected PV system and each modules is connected to one DC-DC flyback converter to achieve best MPPT as well as galvanic isolation to improve efficiency. The DC-DC flyback converters are cascaded to amplify the DC voltage in order to be used for medium and high voltage systems and result output voltage is used as an input to H-bridge. Two MOSFET are operating in line frequency and two at switching frequency. This proposed model will reduce switching losses and improve efficiency due to MLI obtain the best MPPT , get isolation at high frequency eliminating the leakage current ,switching losses and voltage ripple.*

Keywords- *Cascaded H-Bridge MLI, MPPT, Flyback Converter, PV Modules, MOSFET Switches, Galvanic Isolation.*

I. INTRODUCTION

Nowdays PV modules from solar is widely used because it's a renewable source of energy. The primary concept multilevel converter is to achieve higher power is use a several power semiconductor switches with several lower voltage d sources connected in manner such that to perform the conversion by generating a staircase output voltage waveform. Flying capacitor multilevel topology is considered to be an alternative to the NPC topology . This is based on series connection of H-bridge inverters with separate DC sources Each H-bridge can be used to generate three output voltage level by unipolar modulation technique. For each DC source the H-bridge reinstate cascaded connection. Therefore a combination of the multiple h-bridge cells give this technique to be used in medium and large grid connected PV systems. Some of the standalone systems used in VAR compensations and other are grid connected systems. DC sources can be replaced by PV module and due to separate DC link feature the voltage control becomes possible. Galvanic isolation is used for grounding purposes provides safety for the system. The MPPT technique used to track the maximum of energy of the PV panels. The DC-DC flyback converters are cascaded to amplify the DC voltage in order to be used for medium and high voltage systems and result output voltage is used as an input to H-bridge. This technique is useful for reducing losses, voltage ripple, electromagnetic inference, switching losses.

II. SYSTEM DESCRIPITON

The cascaded H-bridge inverter has drawn tremendous interest due to the greater demand of medium-voltage high-power inverters. It is composed of multiple units of single-phase H-bridge power cells. The H-bridge cells are normally connected in cascade on their ac side to achieve medium voltage operation and low harmonic distortion. The cascaded H-bridge multilevel inverter requires a number of isolated dc supplies, each of which feeds a H-bridge power cell. The single phase H-bridge cell, which is the building block for the cascaded H-bridge inverter is associated with separate dc sources.

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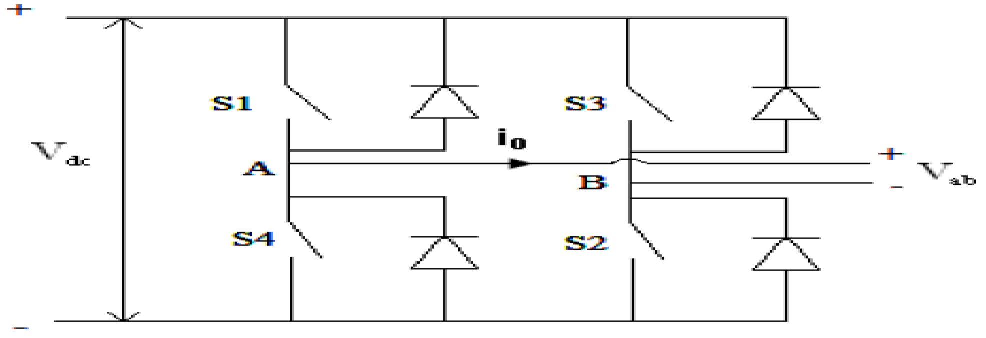

Figure 1. Single Phase H-Bridge

The Figure 2 shows a existing method of PV grid connected system. The Figure 3 shows a proposed method of grid connected PV system

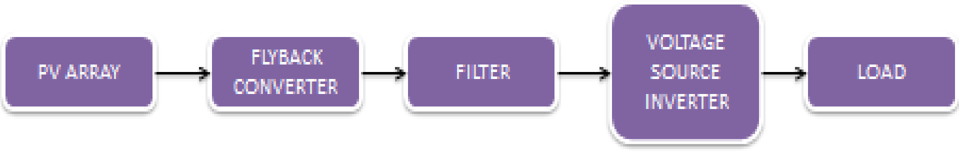

Figure 2. Existing Method

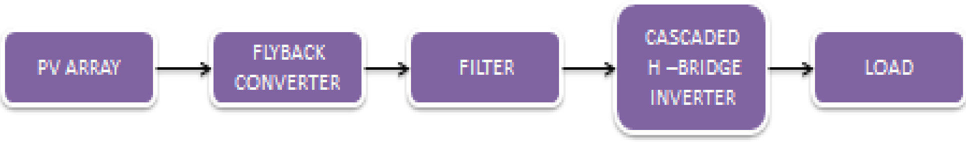

Figure 3. Proposed Method

III. SIMULATION RESULTS

3.1. Flyback with Cascaded Multilevel Inverter with R-Load

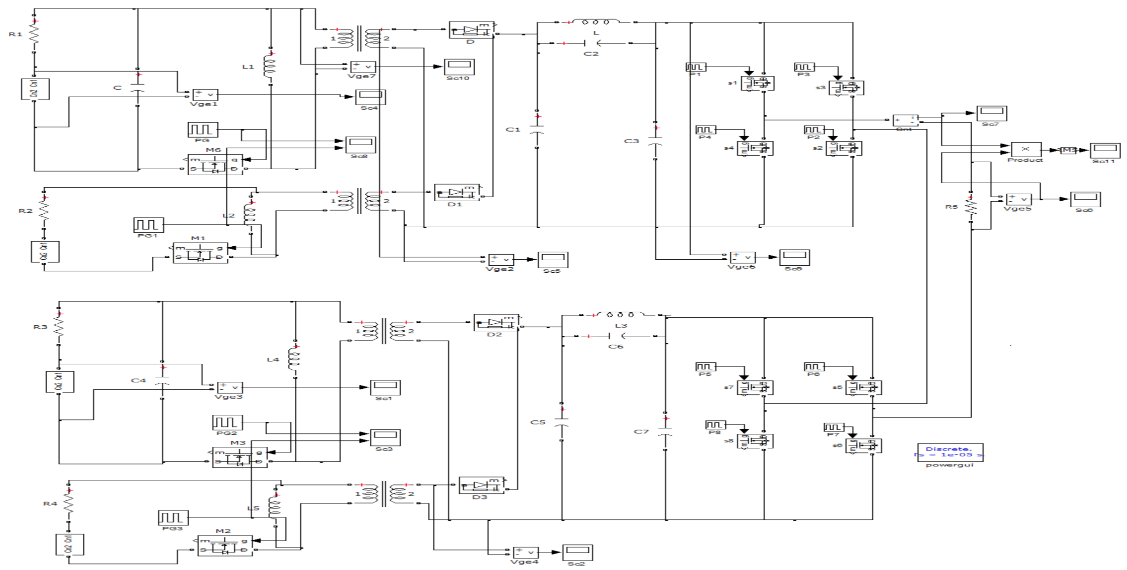

Figure 4.Simulink Model of Flyback with Cascaded Multilevel Inverter with R-Load

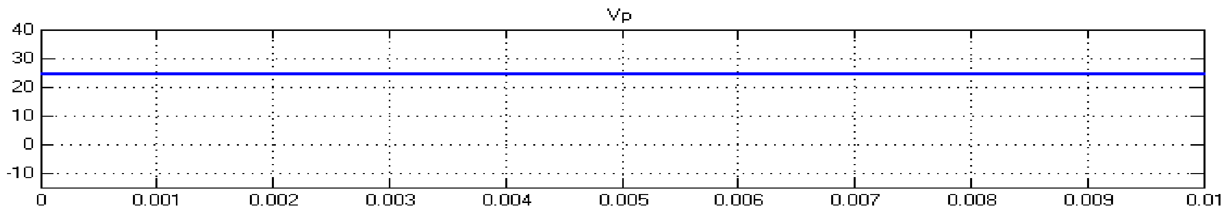

Figure 5. Input Voltage

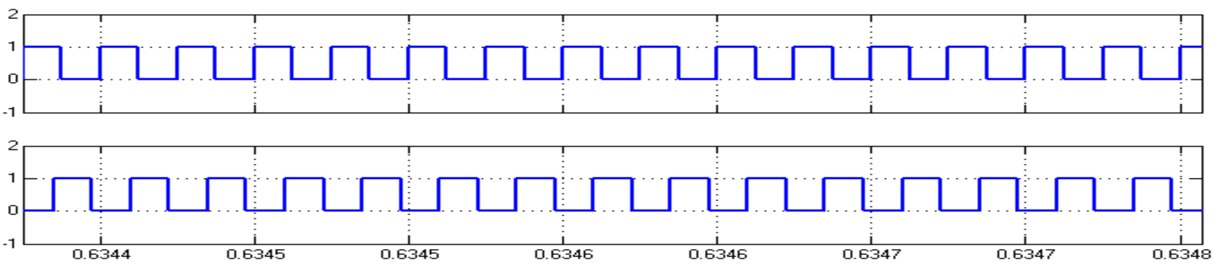

Figure 6.Switching Pulse for Flyback Inverter

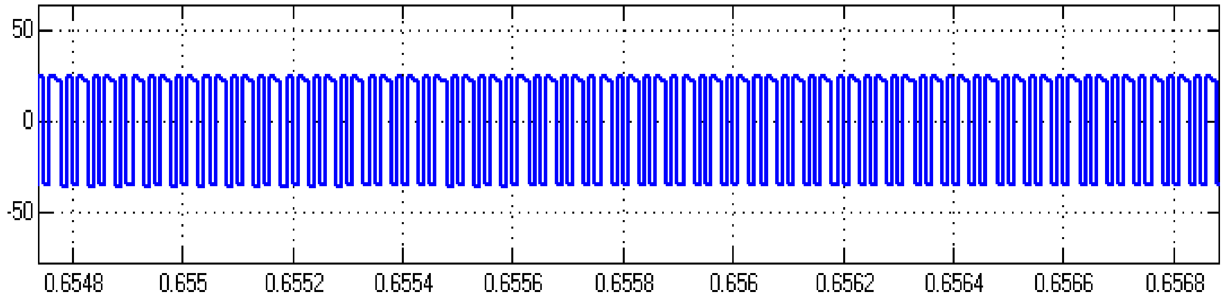

Figure 7.Transformer Primary Voltage

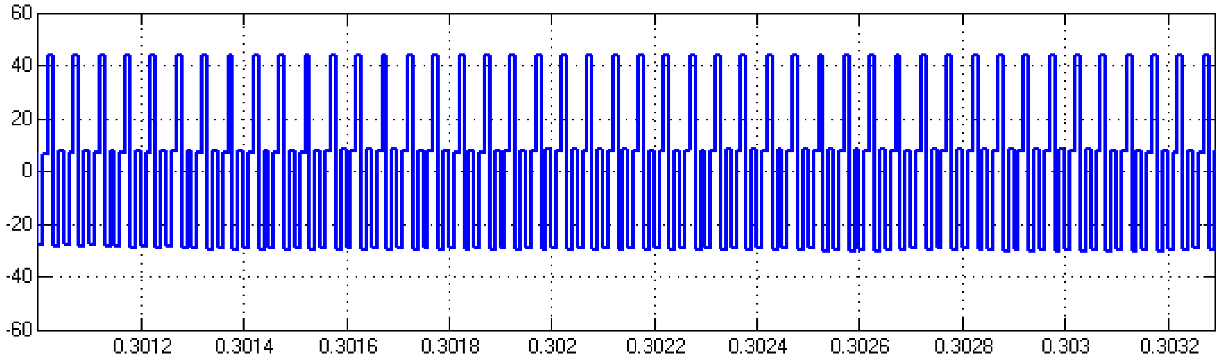

Figure 8.Transformer Secondary Voltage

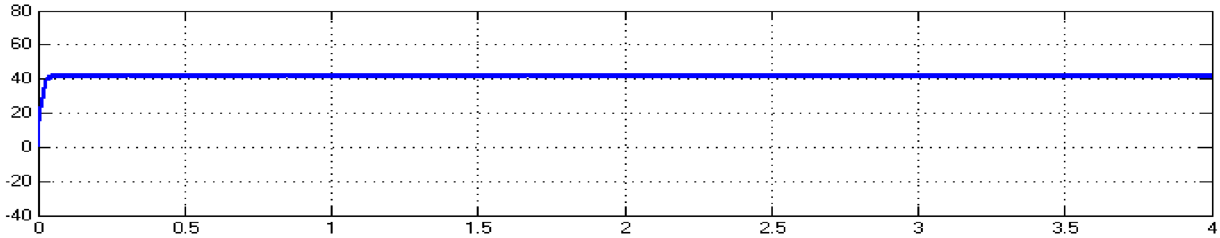

Figure 9.Output Voltage Of Rectifier

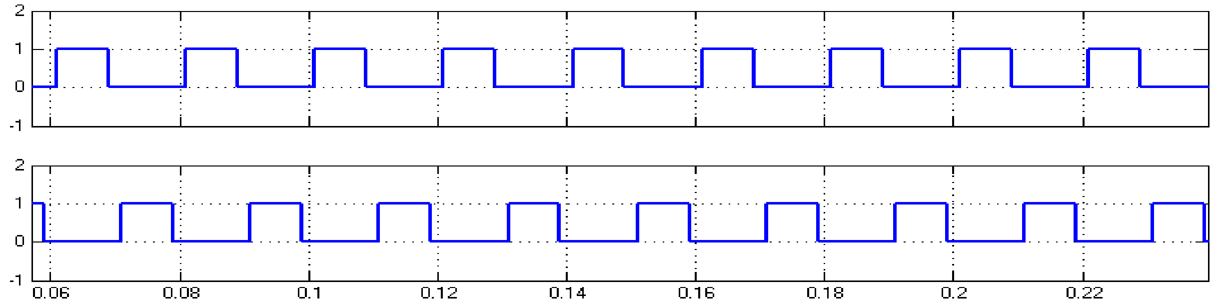

Figure 10.Switching Pulse for Multilevel Inverter (M1, M5)

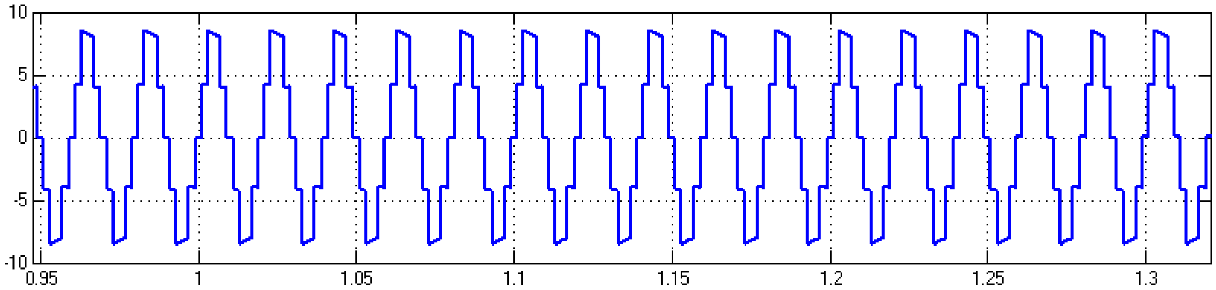

Figure 11.Output Current

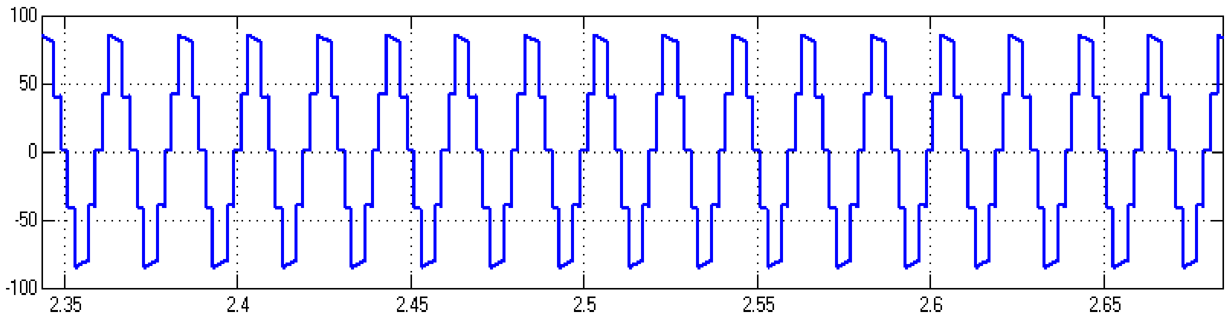

Figure 12.Output Voltage

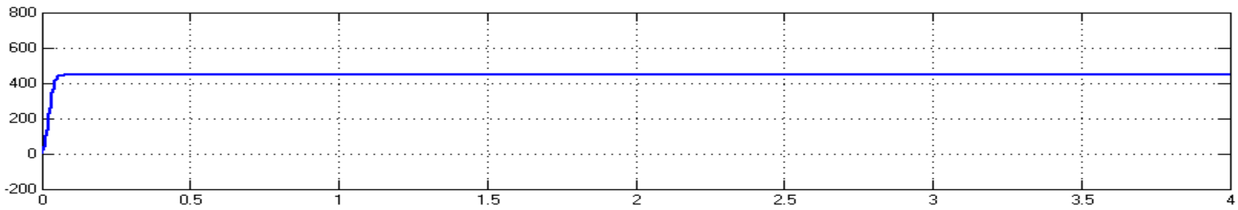

Figure 13.Output Power

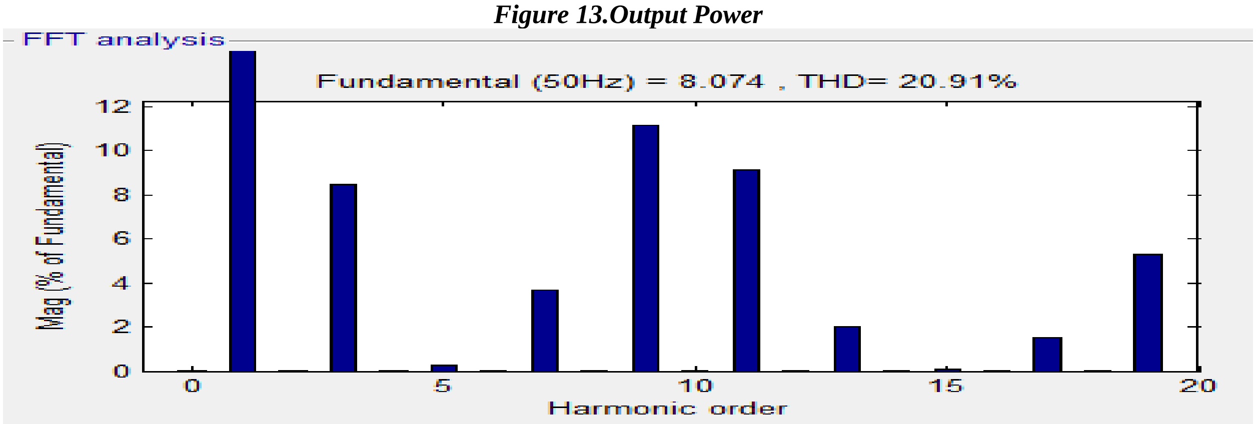

Figure 14.Output Current THD

3.2. Flyback with Cascaded Multilevel Inverter with RL-Load

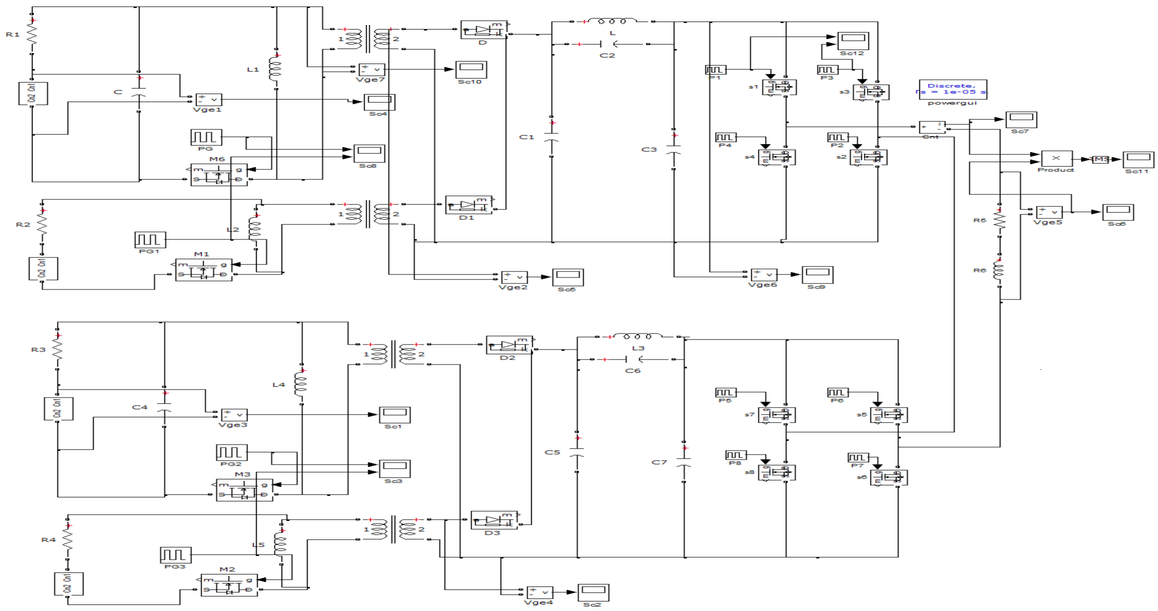

Figure 15. Simulink Model of Flyback with Cascaded Multilevel Inverter with RL Load

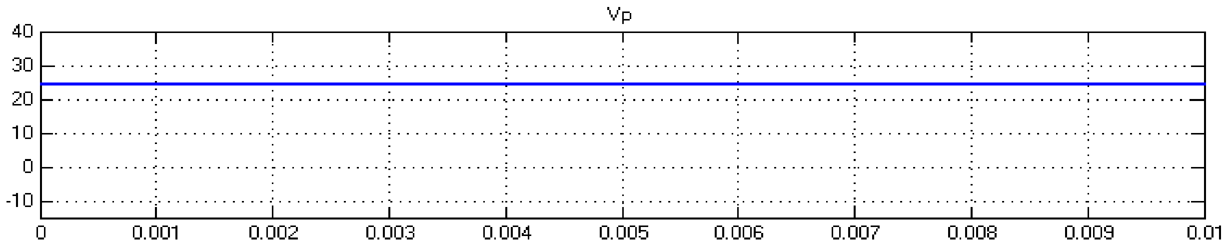

Figure 16. Input Voltage

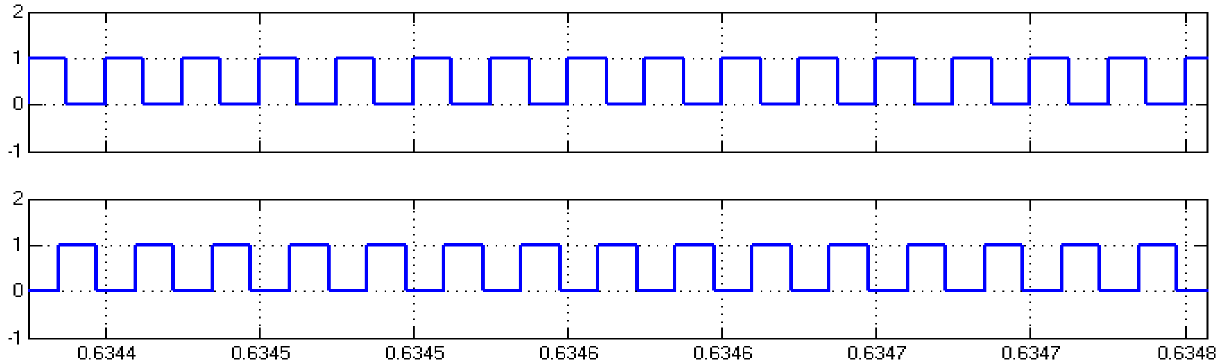

Figure 17.Switching Pulse for Flyback Inverter

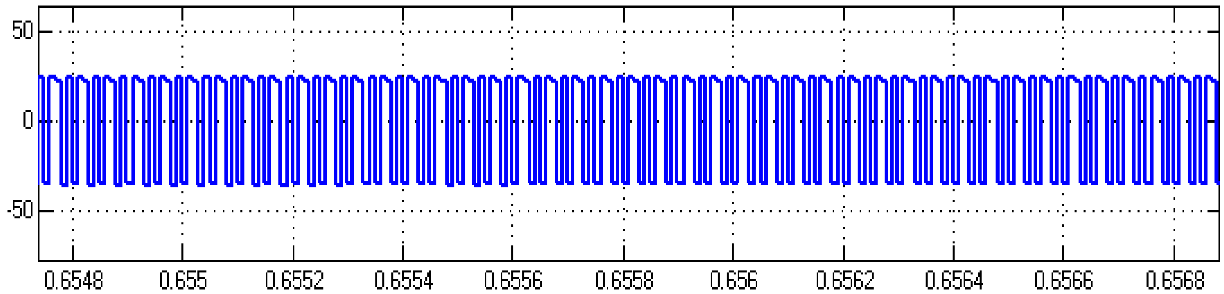

Figure 18.Transformer Primary Voltage

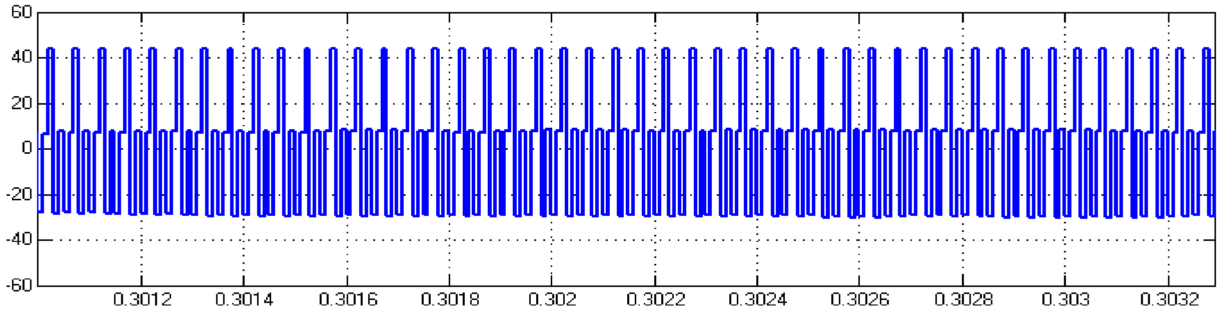

Figure 19.Transformer Secondary Voltage

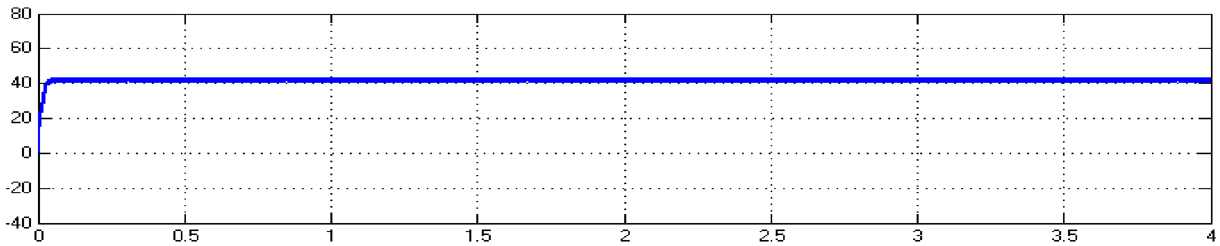

Figure 20.Output Voltage of Rectifier

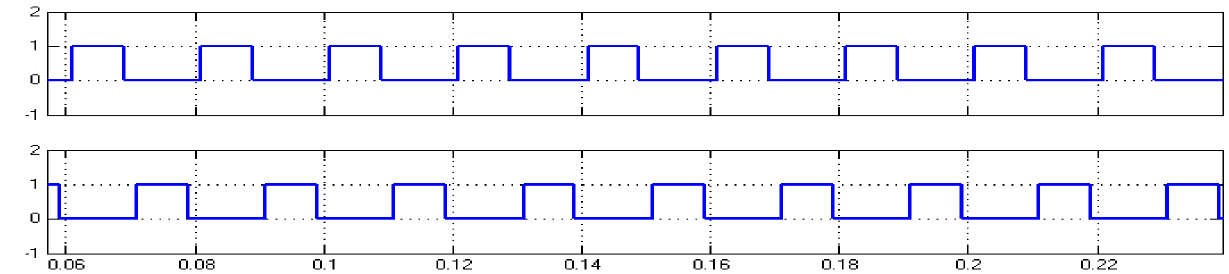

Figure 21.Switching Pulse for Multilevel Inverter (M1, M5)

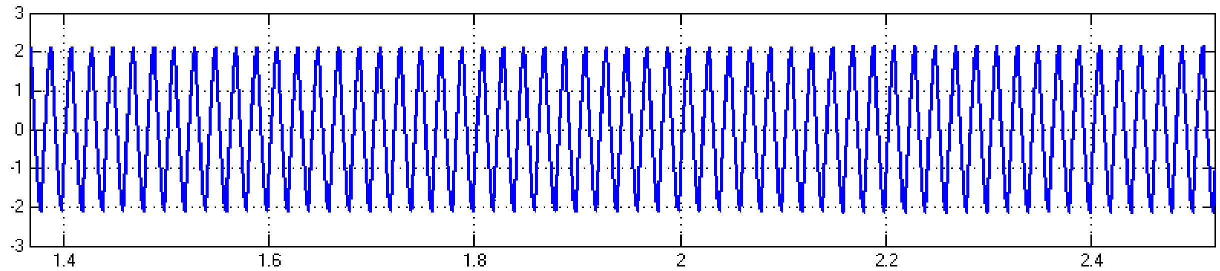

Figure 22.Output Current

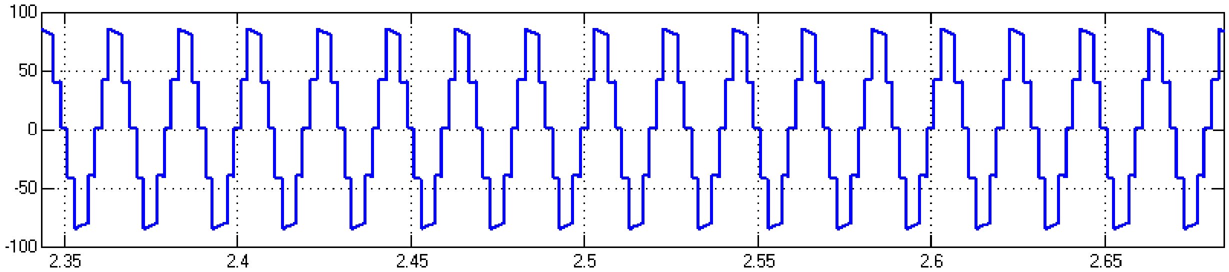

Figure 23.Output Voltage

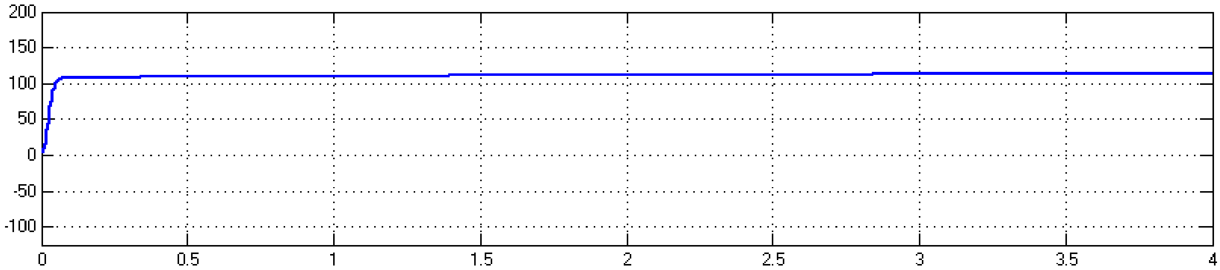

Figure 24.Output Power

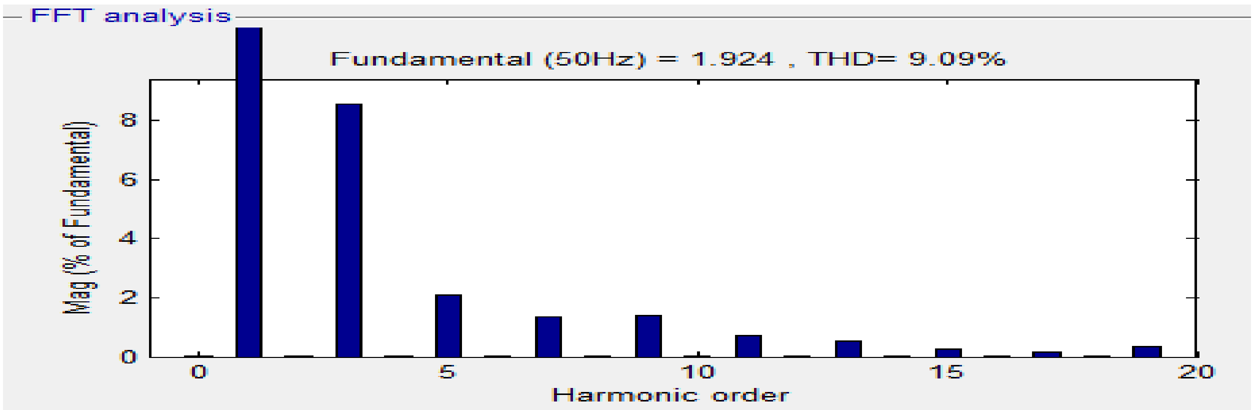

Figure 25.Output Current THD

Table 1.Comaprision of Output Current THD

S.NO	CASCADED H BRIDGE INVERTER	THD%
1	R-LOAD	20.91%
2	RL-LOAD	09.09%

IV. CONCLUSION

The results of interleaved high-power fly back H-bridge multilevel inverter for open loop system with R and RL are compared. The Cascade filter is used to reduce ripple THD with RL load is 11% less than of R load. Reduction in THD is due to the load inductance. This cascaded fly back inverter can be used for high power applications. Harmonics and electromagnetic interference is reduced.

The Scope of present work is to simulate an interleaved high-power fly back multilevel inverter for open loop system. The interleaved high-power fly back multilevel inverter for closed loop system (PI&FLC) will be done in future

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