SIMULATION AND DESIGN OF TRANSFORMER LESS SINGLE PHASE SOLAR INVERTER

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ABSTRACT:-*In this article, solar energy is converted into electrical energy ineffective cost. The components of these solar systems which are mainly used are solar cell, dc to dc boost converters and inverters. Topology used for inverter is sine wave pulse width modulation topology. In this topology four MOSFETs are used. Isolation requirement between control circuit and power circuit is less which helps to decrease the cost of solar inverters. In this article design of components for inverters and boosters are done. Simulation of solar inverter is done and simulation results taken.*

Keywords:-*Dual stage dc-dc boost converter, Sine wave pulse width modulation H-inverter,*

I. INTRODUCTION

The search for the energy source other than conventional sources likes fuels because the energy demand is increasing at an exponential rate. The fossil fuels offer limited solution to this energy crisis and also it is harmful to the environment to generate the electricity because they emission of carbon dioxide and other greenhouse gases. After some of twenty years conventional energy sources will not enough to energydemand.So the search the alternate energy sources like non-conventional energy sources like solar, wind etc. One of the non-conventional energy source like Sun, its offers unlimited solar energy and for this reason, Photovoltaic system. This system consists of PV modules and modules comprise of several solar cell. Solar cells are converting the solar energy directly into DC electricity, and are connected as desired levels of DC current and voltage.

In this paper effective method is used for design thesingle phase solar inverter. Solar cell converts solar energy into DC electrical energy.

This dc voltage is setup using the dual stage dc to dc boost converter. Boost dc voltage is fed into H-inverter. This H-inverter converts dc into ac voltage. Sine wave pules width modulation topology. The output of inverter is given to low-pass filter and then this produced sine wave output.

II. DESING DUAL STAGE BOOST CONVERTER AND INVERTER

Dual stage dc to dc boost conversion ratio $\left(x^2 = \frac{V_s}{v}\right.$. This converter is use for reduce the MOSFET Switching load. Booster is designed for the output voltage of 220 DCV. Overall boost efficiency is taken 95%.Minimum input voltage to dc to dc converter is 21-24 DCV. Relationship between input voltage and output voltage is giving by equation 2.1

$$V_{out} = V_{in}\left(\frac{1}{1-D}\right) \qquad 2.1$$

Where

V_{out} Output voltage,

V_{in} Input voltage,

l Duty cycle

Duty cycle D is .72. Switching frequency of MOSFET is taken 20 KHZ. Switching period is 50us.

Inductor Selection:

$$L = \frac{V_{in}(V_{out} - V_{in})}{\Delta I_L \times f_s \times V_{out}} \qquad 2.2$$

Capacitor Selection:

$$C = \frac{I_{out} \times D}{f_s \times \Delta V_{out}} \qquad 2.3$$

Where

I_{out} = output current,

ΔI Ripple current,

ΔV_{ou} Output ripplevoltage,

From using equation no 2.2 and 2.3 the value of inductor and capacitor is

L_1 = 190uH,

L_2 = 20uH,

C_1 = 3.5mF,

C_2 = 1mF,

III. SIMULATION AND SIMULATION RESULTS

Simulation is carried out in MATLAB Simulink software. Simulation results for dc to dc boost converter are shown in Fig 3.1. Fig 3.1(a) and (b) shows the model and results for input voltage 24V and output voltage 210V l respectively. Fig 3.2 shows the result for sine wave pulse width modulation for switching the inverter MOSFET. Fig 3.3(a) and (b) shows the inverter simulation model and result without low pass filter. Fig 3.4(a) and (b) shows the inverter simulationmodel and result with low pass filter

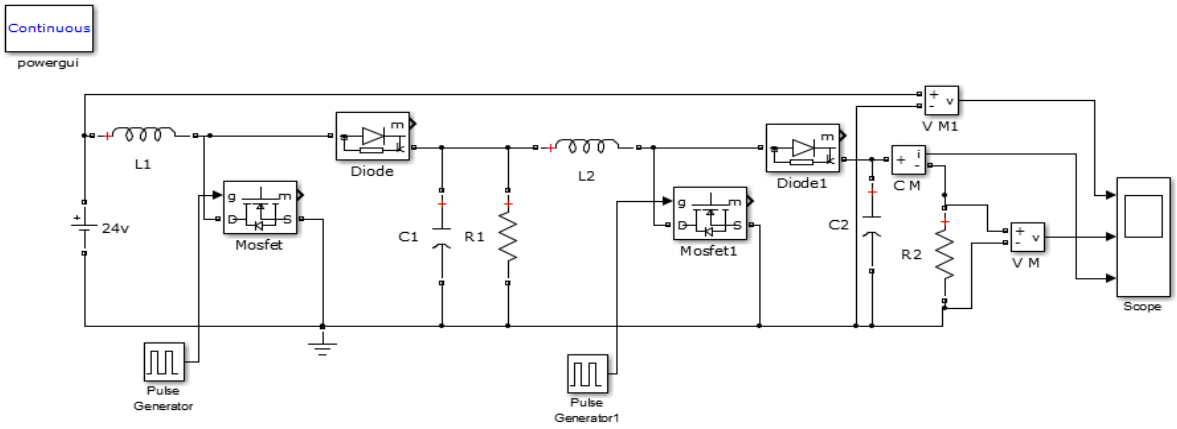

Fig: 3.1(a) Dual stage dc to dc boost converter simulation model.

Fig: 3.1(b) Dual stages dc to dc boost converter simulation result.

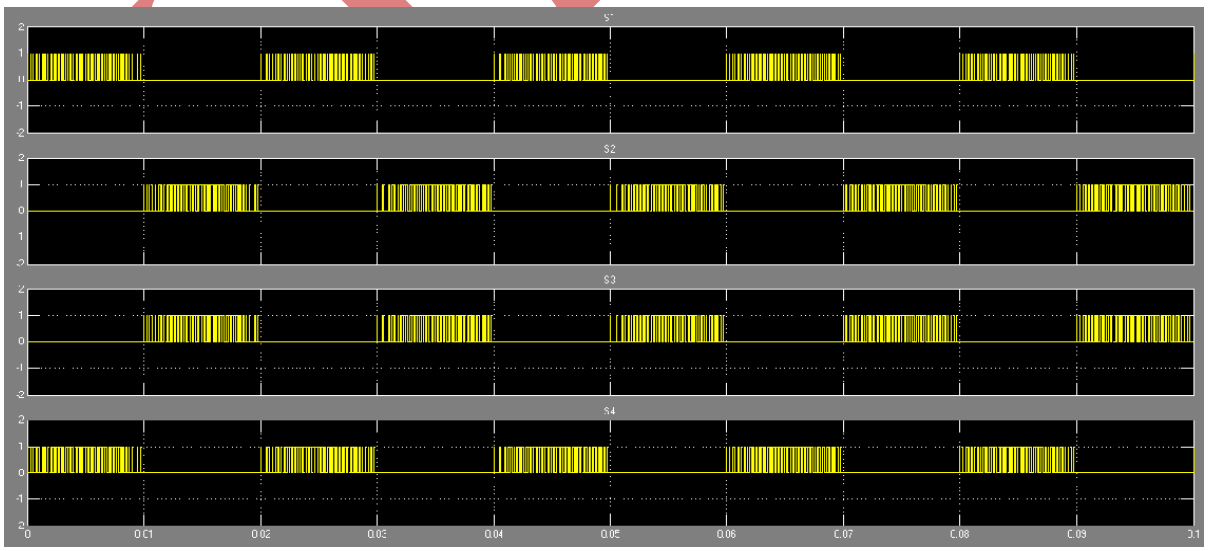

Fig: 3.2spwm signal for MOSFET,

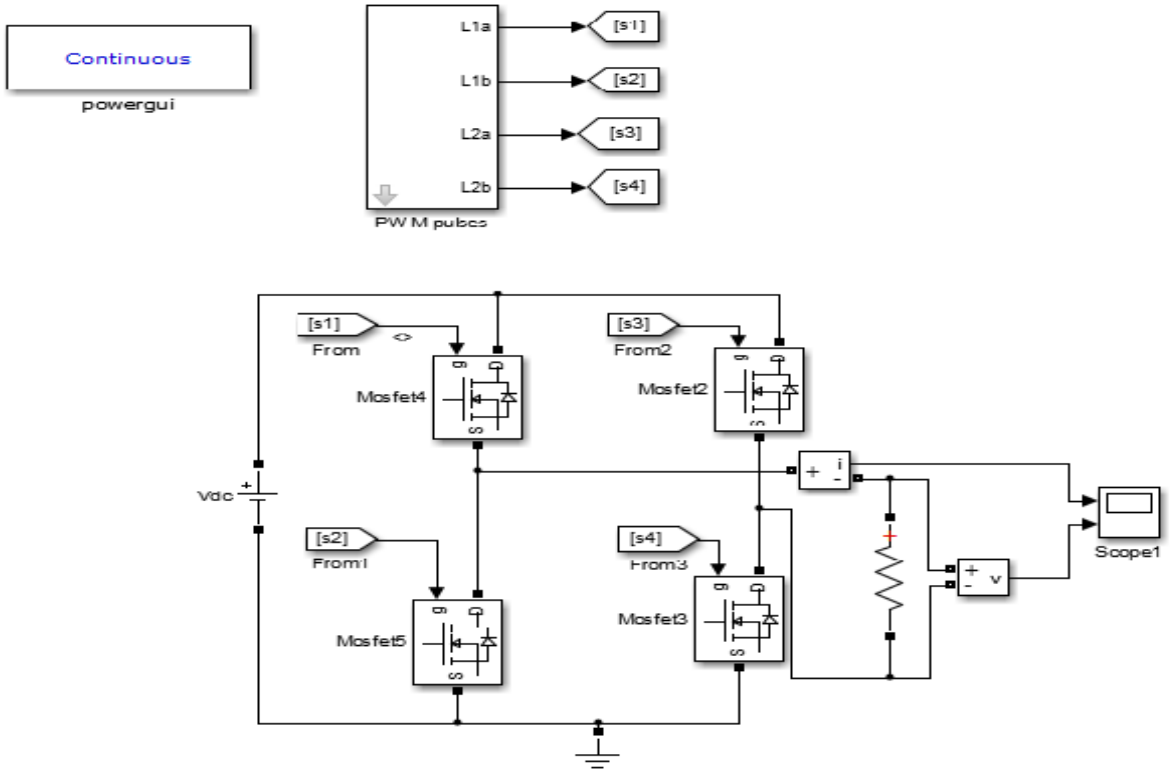

Fig:3.3(a)Inverter simulation model without low pass filter.

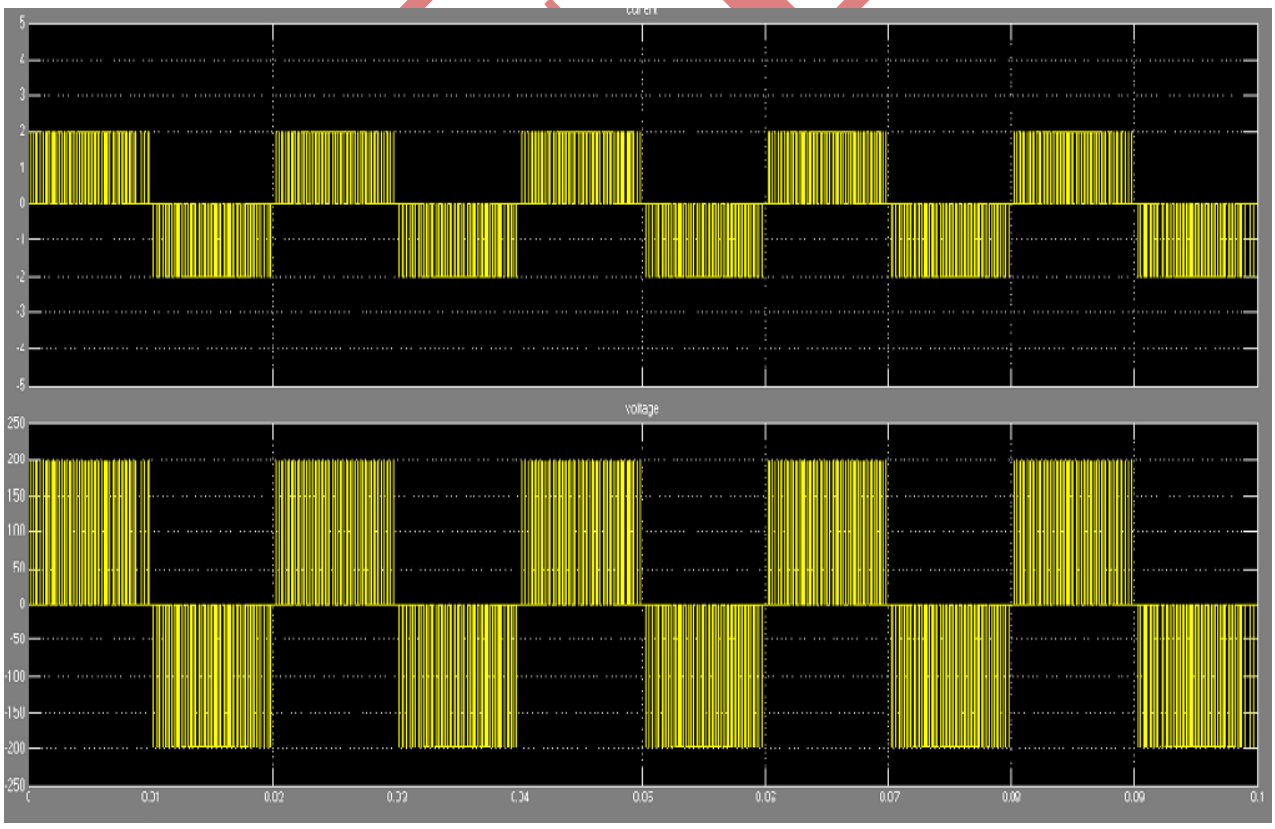

Fig: 3.3(b) Inverter result without filter

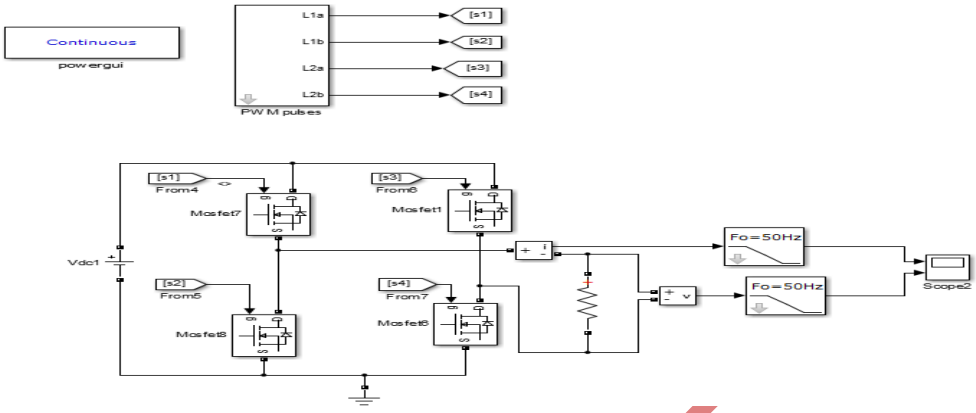

Fig:3.4(a) Inverter simulation model with low pass filter

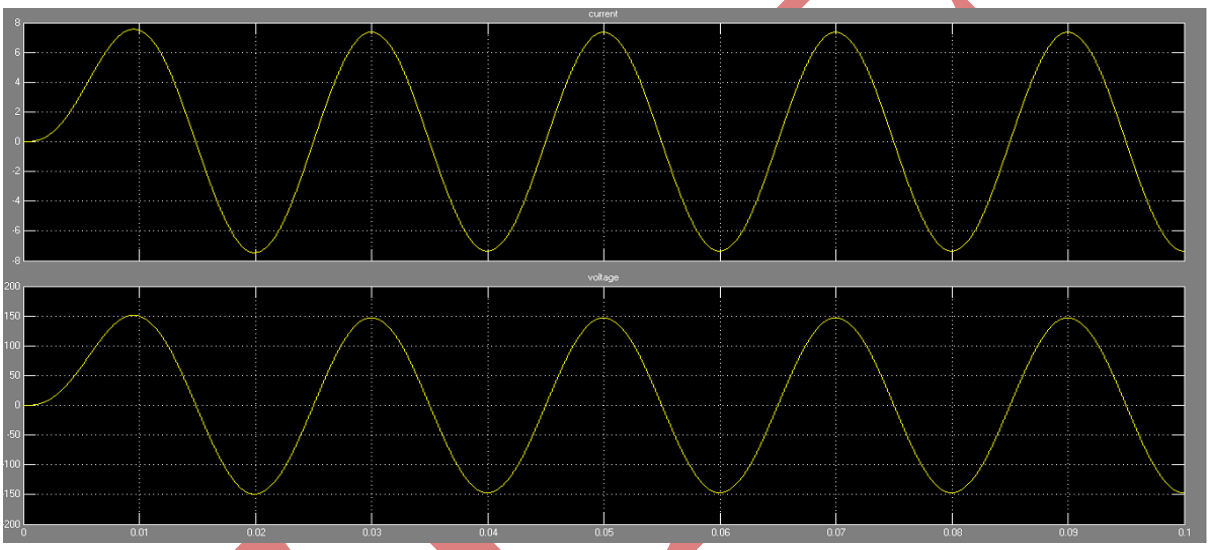

Fig: 3.4(b) Inverter simulation result with low pass filter

IV. APPLICATION

i. This is use in home appliance,

ii. Single phase photovoltaicapplication,

iii. Single phase grid tie for solar power transmission,

V. CONCLUSION

Use of transformer less solar inverter reduces the cost of inverter and increase the efficiency solar system. The advantage sine wave pulse width modulation topology helps to sine wave output.A dc–ac voltage source converter has been proposed and studied both theoretically and experimentally. According to our opinion, the boost inverter is suitable for applications where the output ac voltage needs to be larger than the dc input andcan offer economic and technical advantages over the conventional VSI. Calculated value of the components for dual stage dc to dc boost converter is used to simulate dual stage dc to dc converter and inverter.

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