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Design and Development of Single Switch High Step-Up Modify SEPIC DC-DC Converter

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ABSTRACT

In this proposed converter the single switch can be used to step up dc-dc converter. In other converter the high step up transformer and coupled inductors are used to improve the voltage. The modified sepic converter improve the input voltage by diode-capacitor combination. Normally the output voltage of conventional sepic converter is twice the input. In modified sepic converter the output voltage is 13 times of the input voltage. The proposed converter produce high voltage gain with high efficiency. This project proposes the modified DC-DC sepic converter topology for photovoltaic applications.

KEYWORDS: *SEPIC CONVERTER, PHOTOVOLTAIC SYSTEMS (PV), DC-DC CONVERTERS*

I. INTRODUCTION

Rising in the prices and the limited cost of non renewable energy sources has led to the need of renewable energy sources is also rising. One of the common type renewable energy power source that can be need in PV. The high voltage gain dc-dc converters are used in numerous applications, such as low power wind Turbines, photo-voltaic(pv)systems, fuel cell[1].At now, renewable energy-based PV has used foe the future energy to capable to rectify the problems for global warming and the energy crises caused by the rising in energy consumption. Photo-voltaic based renewable energy has many benefits because it does not require fuel, pollution-free, and no noises. In addition, photovoltaic modules also have a lifespan of up to 20 years so can reducing the money. The voltage output of a single pv cell is quite low,thus a high and efficient voltage boost is mandatory to obtain an increased performance. In addition there is always a high variation in the generated pv voltage due to varying solar radiation and temperature[2].To generate the power generation based on photovoltaic system, there are many steps that can be completed before the output voltage of photo-voltaic connect with the grid system. To use a dc-dc converter in renewable energy sources,

it should have a high voltage transfer[3],[4]. The conventional schemes are by installing high frequency step-up transformer or by boost the voltage of photo-voltaic with normal boost converter. Recently, many research works have been done in dc-dc converters to achieve high voltage gain. The usual solution for a high step up gain is the use of isolated dc-dc converter[5]-[8].The high step up non isolated dc-dc converters can be categorized as non coupled inductor and coupled inductors converters[9].The voltage transfer gain of the converter is (3D+1)/(1-D) which is higher than the converters in [10].The use of high static gain and low switch voltage topologies can improve the efficiency operating with low input voltage is proposed in[11]-[13]. However, the model of DC-DC converters, are typically need conventional converters to high static gain in order to rise the output voltage of the PV system and increase the efficiency.

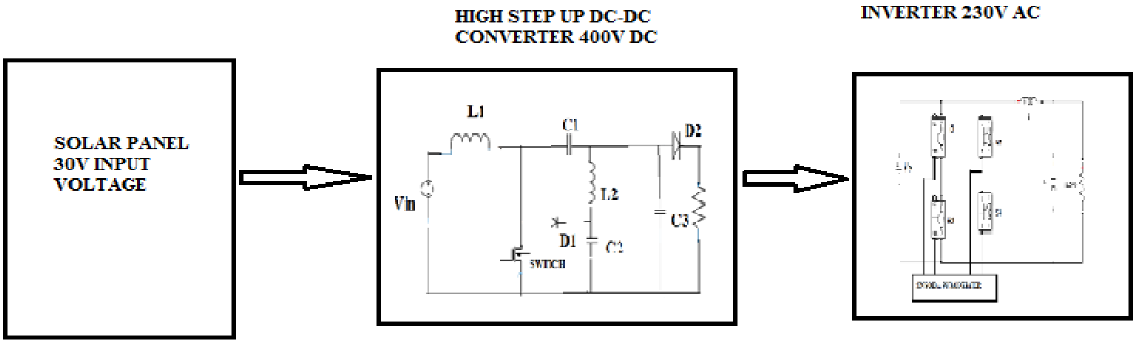

Fig.1Blockdiagram

II. CIRCUIT CONFIGURATION AND WORKING

Boost, Buck converter voltage or current gain of the SEPIC converter for operation of characteristics for a different type of input voltage gadgets. More over the switch voltage is same as the add a input and output voltage. The change of the SEPIC converter are accomplished to the install of the diode D1 and the capacitor C1, are presented.Capacitor C1 is energized for the output voltage of the conventional step up converter. The voltage used to L2 inductor at the time of conduction of the semiconductor switch (S) is higher than in the conventional SEPIC converter, to rising the static gain. The enormous usage in conduction mode operation of the modified SEPIC converter presents two operating stages. Every capacitor is selected as a source of voltage for the derivative analysis.

1) First Stage(Fig.3) - When S is the turn-off and the energy charged in the input inductor L1 is transfer to the output by the C1 capacitor and diode D1 and also is transfer to the C2 capacitor by the diode D1. Voltage from the switch voltage is same as the C1 of the capacitor voltage. The energy charged in the inductor L1 is transfer to the output by the diode D2.

2) Second Stage(Fig.4) - When, switch S is turn-on and the diodes D1 and D2 are reverse biased and blocked, the inductors L1 and L2 storing energy. The voltage of input is applied to the L1 and the voltage Vc1-Vc2 is applied to the L2. The Vc1 voltage is more thantheVc2

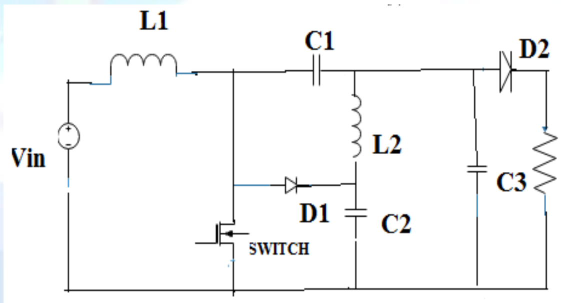

Fig.2 Circuit Diagram of Proposed System

MODE1

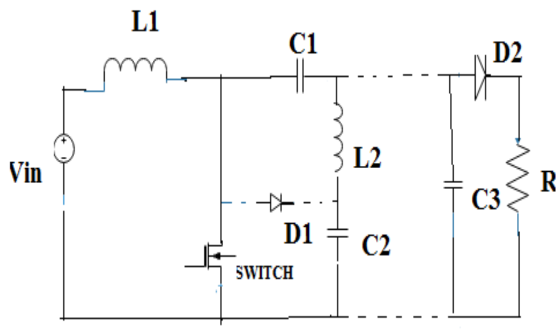

Fig.3Continuous Mode 1

MODE 2

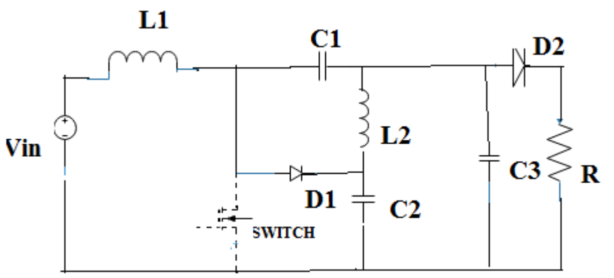

Fig.4 Continuous Mode 2

III. MAXIMUM POWER POINT TRACKING INCREMENTAL AND CONDUCTANCES ALGORITHM

The gradual conductance calculation depends on the way that the slant of the bend power versus voltage (current) of the PV module is zero at the MPPT, positive (negative) on its left and negative (positive) on the privilege

P=0 (IP=0at the MPPT

P>0 (IP<0) on the left

P< 0 (IP>0) on the Right

By looking at the augmentation of the force versus the augmentation of the voltage (current) between two consecutives tests, the adjustment in the MPPT voltage can be resolved. In both P&O and INC plans, how quick the MPPT is reached relies upon the size of the addition of the reference voltage. The downsides of these procedures are mostly two. The first and primary one is that they can without much of a stretch forget about the MPP if the illumination changes quickly. If there should be an occurrence of step transforms they track the MPPT quite well, on the grounds that the change is immediate and the bend doesn't continue evolving. Nonetheless, when the illumination changes following an incline, the bend where the calculations are based changes persistently with the light, as can be found in Figure.4, so the adjustments in the voltage and current are not just because of the bother of the voltage. As an outcome it is unimaginable calculations to decide if the adjustment in the force is because of its own voltage increase or because of the adjustment in the illumination.

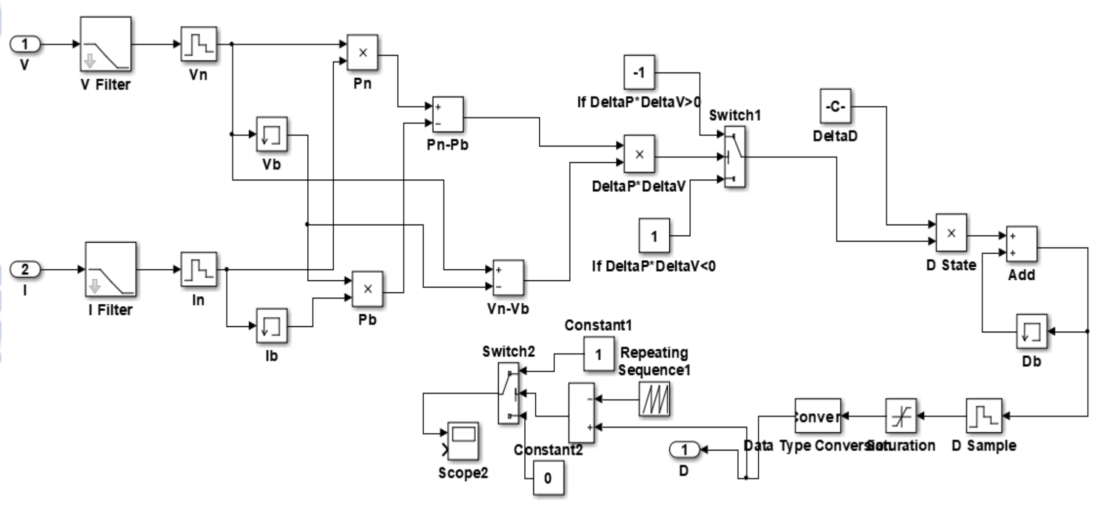

Fig.5 Incremental and conductances algorithm

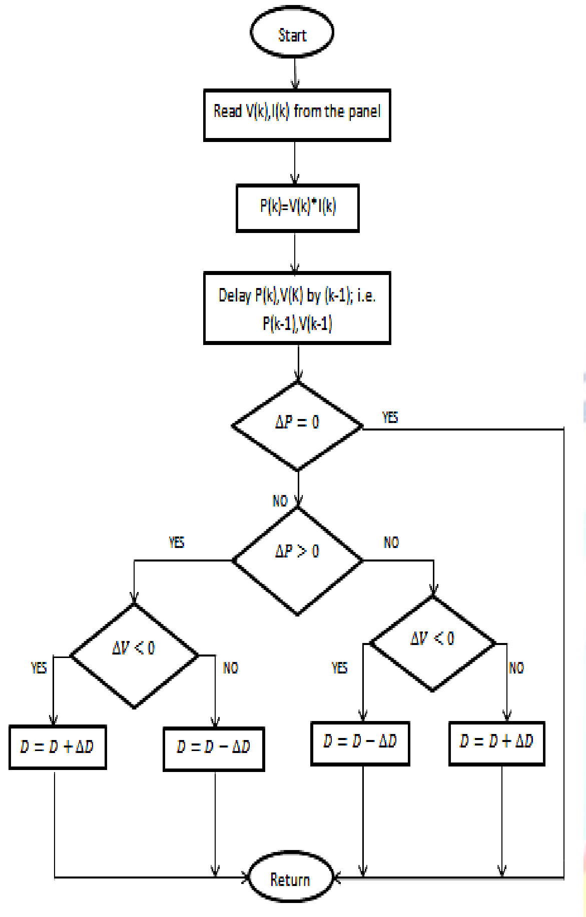

Fig.6 Incremental and conductance algorithm flowchart

IV.SINGLE PHASE INVERTER

The working principle of single phase full bridge inverter is based on the sequential triggering of switches placed diagonally opposite. This means, for half of time period, switches s2 & s3 will be triggered while for the remaining half of time period, s1 & s4 will be triggered. Only two switches are turned ON in half of the time period. Carefully observe the waveform of the gating signal. You will notice that switches s1& s4 are triggered simultaneously for a time T/2. Therefore, load is connected to source through s1 & s4 and hence, the load voltage is equal to the source voltage with positive polarity. This is the reason; the load voltage is shown positive & equal to Vin the output voltage waveform. As soon as the gate signal (ig1 & ig4) are removed, s1 and s4 get turned OFF. However, at the same instant gate signal (ig2& ig3) are applied and hence, s3 & s4 are turned ON. When s2 & s3 are conducting, load gets connected to the source. The load voltage magnitude is again Vs but with reverse polarity. This is the reason, the output voltage is shown negative in the voltage waveform.

To summarize,
For the time 0<t≤(T/2), switches T1 & T2 conducts and load voltage Vo = Vs.
For the time (T/2)<t≤T, switches T3 & T4 conducts and load voltage Vo = -V

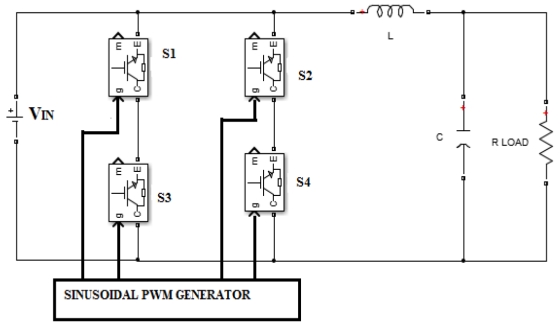

Fig.7 Single phase inverter

V.DESIGN OF THE CONVERTER

Input voltage=30V from solar panel
Output voltage=400V DC
Switching frequency=24KhZ

DUTY CYCLE

Duty cycle=2*Vout3Vin/2*Vout+Vin

VOLTAGE GAIN

- Voltage gain =3+D/2(1-D)

INDUCTANCE L1, L2

- Inductance L1,L2= Vin*d/ΔIL*Fs,

  Where, ΔIL=D*Vs/F*L

CAPACITANCE C1, C2

- Capacitance C1,C2=I out*D/ ΔVc*Fs

  where, ΔVc =Vin*0.01/(1-D)

POWER SWITCH VOLTAGE

- Power switch voltage Vs=Vin/(1-Di)

EFFICIENCY

- Efficiency=Inverter Power/Converter Power

Where,
Inverter power=Inverter voltage*Inverter current
Converter power=Converter current *converter voltage

Where,

Vout-Output voltage
Vin-Input voltage
D-Duty cycle
Fs-Switching Frequency ΔIL-Change in inductor current

ΔVc-Change in capacitor voltage

VI.COMPONENTS AND PARAMETERS OF SIMULATION-CONVERTERPARAMETERS

Table.1 Converter parameters

S.NO	COMPONENTS	PARAMETERS
1	Maximum output power	250W
2	Input voltage	29.8V
3	Output voltage	400V
4	Switching frequency	24KHF
5	Switch	Power Mosfet
6	Diode	p-n diode D1,D2,D3
7	Inductance L1,L2	3.75MF
8	Capacitance C1,C2	1MF
9	Output Capacitance C0	0.5MF

INVERTER PARAMETER

Table.2 Inverter parameters

S.NO	COMPONENTS	PARAMETERS
1	Inverter input voltage	400V DC
2	Inverter output voltage	230V AC
3	Switch	Mosfet
4	Resistor	100 Ohm
5	Inductor	10mH
6	Capacitor	6mF

VII.SIMULATION

SIMULATION DIAGRAM

The simulation of proposed modified sepic dc-dc converter can be designed in matlab simulink platform.

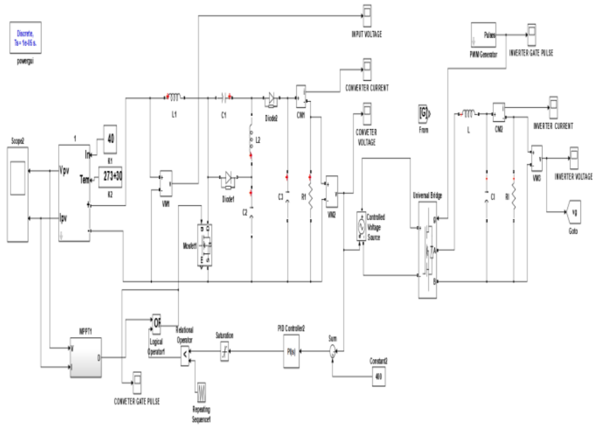

Fig.7 Simulation of proposed system

INPUT VOLTAGE

The simulated input voltage is represented in the fig.8,here the input voltage value is 29.8V

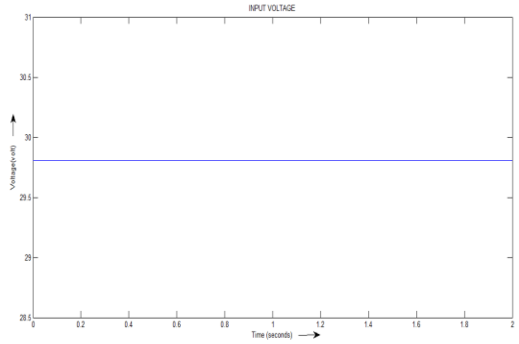

Fig.8 Input voltage waveform

CONVERTER CURRENT

The simulated converter output current is represented in the fig.9,here the

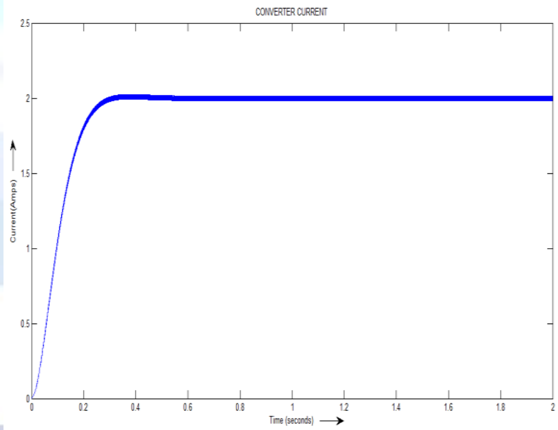

Fig.9 Converter current waveform

CONVERTER VOLTAGE

The simulated converter voltage is represented in the fig.10,here the converter voltage value is 400V.

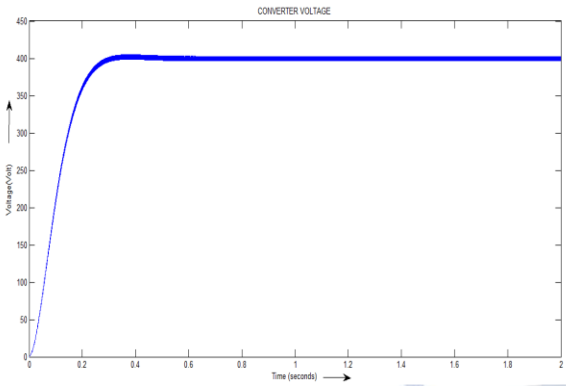

Fig.10 Converter voltage waveform

INVERTER CURRENT

The simulated inverter current is represented in the fig.11,here the inverter current value is 5A.

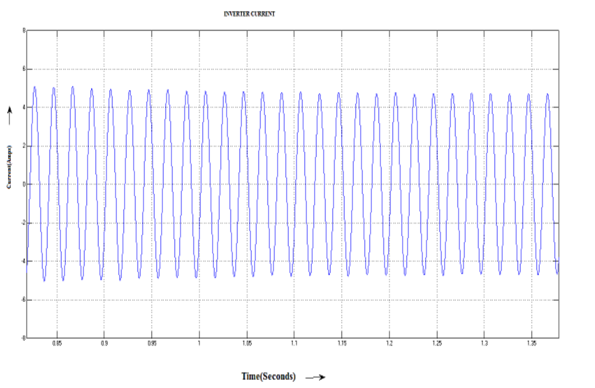

Fig.11 Inverter current waveform

INVERTER VOLTAGE

The simulated inverter voltage is represented in the fig.8,here the inveter voltage value is 230V.

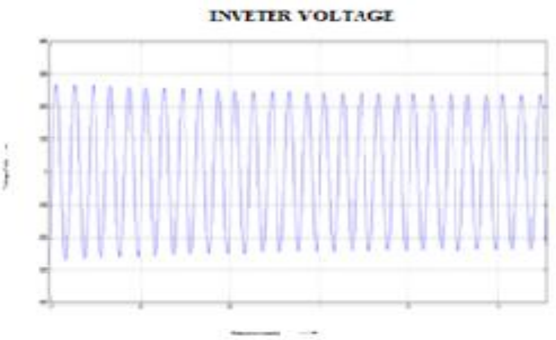

Fig.11 Inverter voltage waveform

VIII. CONCLUSION

This results are done through matlab simulation of a modified SEPIC DC-DC converter with high static gain. It can be concluded that Modified sepic converter can be able to increase the voltage with maximum load. Thereby, the proposed converter output is 13 times of the input voltage of the converter. In addition, proposed controller based MPPT and PI effectively working to maintain the output voltage of the converter.

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