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Single Phase PV Cell Fed H-Bridge Single Level Inverter through Boost Converter

Sachin Kumar[1], Saad Nazif Ahamad Faruqui[2], Mati-ur-Rehman[3]
[1]*M.Tech Research Scholar,* [2]*Assistant Professor & Doctoral Research Scholar,* [3]*Assistant Professor, Department of Electrical Electronics and Communication, AL-FALAH University, Faridabad, Haryana, India*[1]
[2]*Assistant Professor & Doctoral Research Scholar, Department of Energy and Environment, TERI School of Advanced Studies, New Delhi, India*

Abstract: ***This research paper presents a single-phase H-bridge inverter is to be developed using sinusoidal pulse width modulation technique used for photovoltaic cell applications. H-source transformerless topology prepared here shows advantages over the existing conventional inverters topology. This proposed topology uses single phase processing unit making it fewer components count, compact and reliable in nature. Maximum Power Point Tracking (MPPT) is used if voltages are low by buck or boost methods. DC component are at its limit. THD is at low. This results of the H-source multilevel inverter topology is verified using MATLAB Simulink Model.***
Keywords: H-BRIDGE SINGLE LEVEL INVERTER THROUGH BOOST CONVERTER

I. INTRODUCTION

This paper introduces a single level dc-dc boost inverter using H-bridge and source photovoltaic array. It implies under the normal operation, the level of THD is approximately 60% such a situation is undesirable and causes more losses [2].
They are a renewable energy system that converts existing energy into sunlight which can be in the form of heat or electricity. Renewable energy such as wind, solar, water is energy which is often available for the utilization. The curiosity of using renewable energy has jumped in the coming years to reduce responsibility on non-conventional sources so that they can create green and clean energy [2].
It is environmental eco- friendly and without abundant pollution. Which decrease the greenhouse effect. Solar power electricity generation depends on photovoltaic (PV) system and heat energy. The general way of creativity is to use the photo voltaic panel, which will capture the photon energy from the sun and change into electrical energy. In this model we have used active solar technique includes the use of photovoltaic (PV) panels and solar thermal accumulators to stat up the energy the performance of photovoltaic. The performance of the photoconductor depends on the spectral distribution of solar radiation. The standard spectral distribution is used mainly as a reference for evaluating the photovoltaic device.
The solar radiation that is directly perpendicular to a plane. This is directly identical to the Sun, which is commonly known to measure global radiation, which is used by a device called the pyrometer. The process of permuting light (photons) in electricity (voltage) is called photovoltaic (PV) effect.
Photovoltaic arrangements is prepared to PV cells are made of semiconductor materials like a silicon PV cell around o.4.voltag. All PV cells are connecting in a series for high voltage range and connect in a shunt for high current range in case of night but production of modules is not enough to meet the needs of business or home so we have used PV array. Most of PV arrays utilization an inverter to change the DC power in to alternating current (AC) that can power cut motor, lights, motors load etc.
The modules in a photovoltaic (PV) array are generally connected in series to acquire the required voltages; the individual modules are then connected in a parallel to allow the system to produce more than required current.

II. TOPOLOGIES OF SINGLE LEVEL INVERTER

The advantages of single level inverters are follows as: Better result waveform with lower small filter size, THD and low EMI. These day's main topologies is. [5][6]

A. Single Level Inverter Topologies Are

1) Flying capacitor [2];
2) Neutral point clamped.
3) Cascade H-bridge inverter [5] [6]

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We have use to H-bridge inverter shown in fig. [1][2].

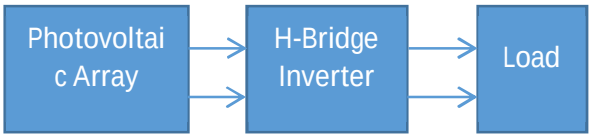


Fig.1. Block Diagram of H-Bridge Inverter

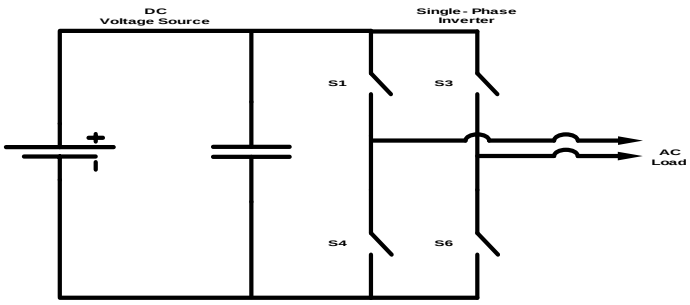


Fig.2 Circuit Diagram of single phase h-bridge inverter

In cascade H Bridge inverter is linked to a separate single phase DC source full bridge. There are produce different voltage level commonly by DC source connected to AC output by different connection of four switches S1, S4, S3 and S2 are generated,0, + VDC, -VDC, Switches are made for S1 and S2 positive half cycles. S2 and S3 switches are made for negative half-wheel shown in table1.

Table 1. Switching States of Single Phase h-bridge Invertr

Serial No	Switching State	Output Voltage
1.	S1=ON,S2=ON	+VDC
2.	S2=ON,S3=ON	0
3.	S3=ON,S4=ON	-VDC

We have use to H-bridge inverter in dc-dc boost inverter fig. [3][4].

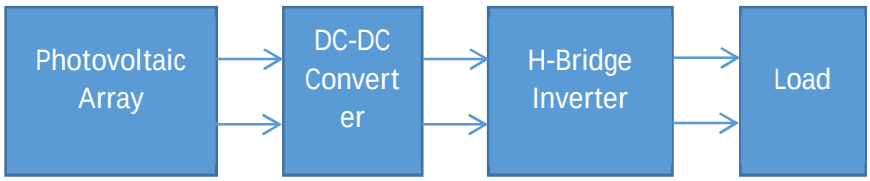


Fig. Block Diagram of DC-DC H-Bridge Boost Inverter

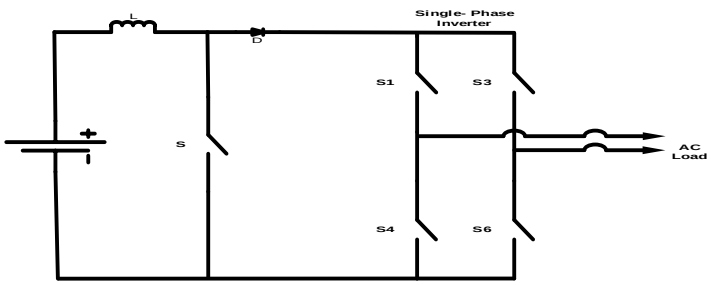


Fig.4, Circuit diagram of DC-DC boost inverter

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Each phase is connected to any node of the capacitor. The connections of the phase of the junction can be completed by switching to both S1 and S2, respectively. Connection is completed by closing order S1 and S2. And this representation, S2 and S1 are for positive (+) half-cycle. S4 and S3 are for negative (-) half-cycle.

The result of levels can be increased by changing the value of capacitor, inductor, diode and resistance in single level inverter, number of capacitors and switches. Different cases of single level diode clamped inverter are shown in fig [4]. The reduction in switching lasses is commonly achieved by some form resonce and it is commonly used to table advantage of its condition capabilities without paying the prices in terms of switching lasses is the series resonant half bridge. One capacitor have been added in parallel with the IGBTs (Switching) this simple addition causes a fundamentals change in the way this topology operates the output of the half bridge is a high frequency square wane of voltage that is applied to a resonant circuit formed by the coil and by one personality capacitor

III. PV MODULE

Photovoltaic system the most important part is solar cells, Due to the low voltage produced in a photovoltaic (PV), several photovoltaic cells are linked in series for high voltage and in parallel for high current to form a PV module for demand output. The standard solar panel consists of silicon cells, a metal frame, a glass casing and various wiring to allow current to flow current to flow from silicon cells, when light falls on solar cells, causes electrons to set into motion. Which absorbs solar radiation? This leads to the current flow, known as “PHOTOVOLTAIC EFFECT”.

$I_{Lg} - I_d - (V_D/R_{SH}) - I_{PV} = 0$ ⟶ (1)

$V_{PV} - V_D + I_{PV}R_S = 0$ ⟶ (2)

I_{Lg} = Light generated current

I_D = Current across diode

V_D = voltage across diode

R_{SH} (Ω) = Shunt resistance in ohms (Ω)

R_S (Ω) = Series resistance in ohms (Ω)

The single diode equation is show below:

IPV - Ilg - Isat { eQ/nKT(VPV + IPVRS) -1} – RSH (VPV + IPVRS) (3)

VPV (V) = output voltage of module PV
IPV (A) = Output current of module PV
Isat (A) current is states of saturation of PV module. Used (K) Kelvin for temperature of PV module. For attaining highest power networks works on maximum power point, which helps in operating at maximum increase d efficiency.

A. Standard Test Conditions

The compare between various photovoltaic cells can be depending on the basis of their characteristic curve and performance. The parameters are always given in datasheet. The datasheet make provides the remarkable parameter about the performance and characteristics of PV cells with respect to standard test condition.
Standard test conditions are as follows:
Temperature (Tn) = 250c
Irradiance (Gn) = 1000
Spectrum of x = 1.5 i.e. AM.

IV. MAXIMUM POWER POINT TRACKER (MMPT)

The efficiency will be maximized if we track the maximum power from the different PV system at various environmental conditions such as temperature and solar irradiance by using various methods for maximum power point tracking (MMPT). A distinct relation among total resistance, temperature and solar radiation that leads to non-linear output from PV panels. The main objective of MMPT arrangement is get output power from various Modules and put in actual resistance to produce maximum power available in various environmental situations of radiations.

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V. H. BRIDGE

A common use of H Bridge is an inverter. The system is sometimes known as a single-phase bridge inverter.
With DC supply H Bridge will generate a square wave voltage wave across the load. For purely inductive weight, the current wave will be a triangle wave, on which the peak will be based on installation, switching frequency and input voltage. Simulink Mode and waveform of H-bridge inverter [6] shown fig.5, 6

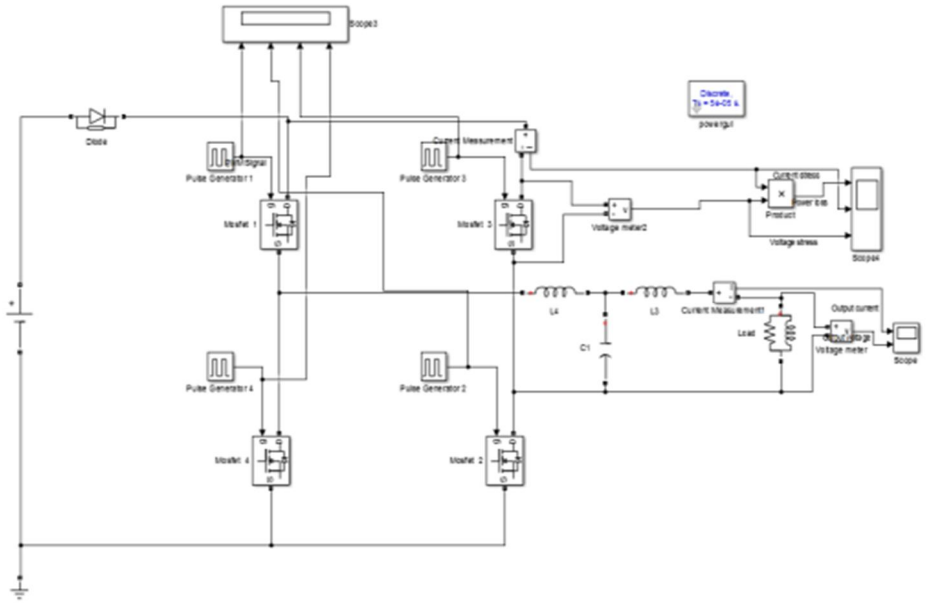


Fig.5.Simulink Model of H-bridge inverter

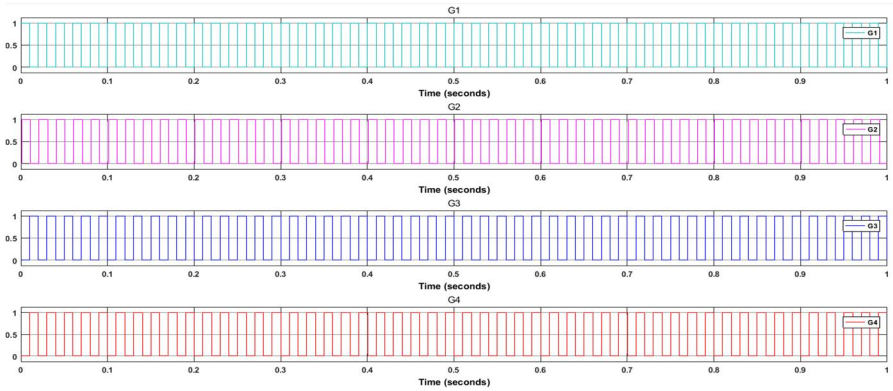


Fig.6 Pulse generator output

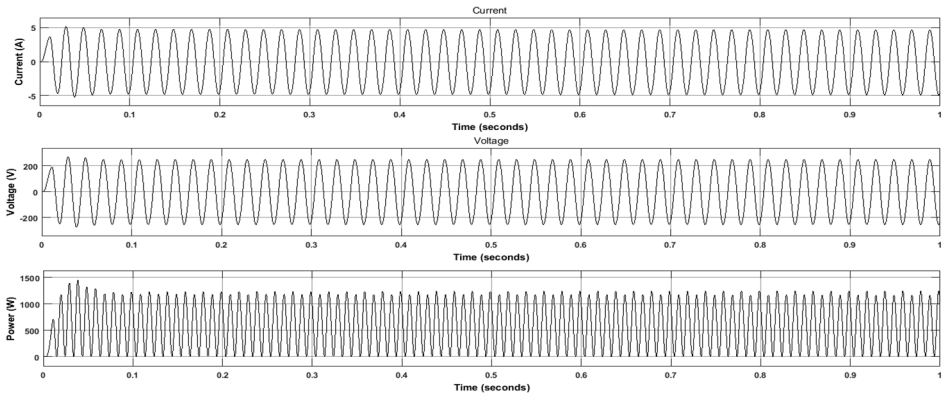


Fig.7. Output current, voltage and power of H-Bridge inverter

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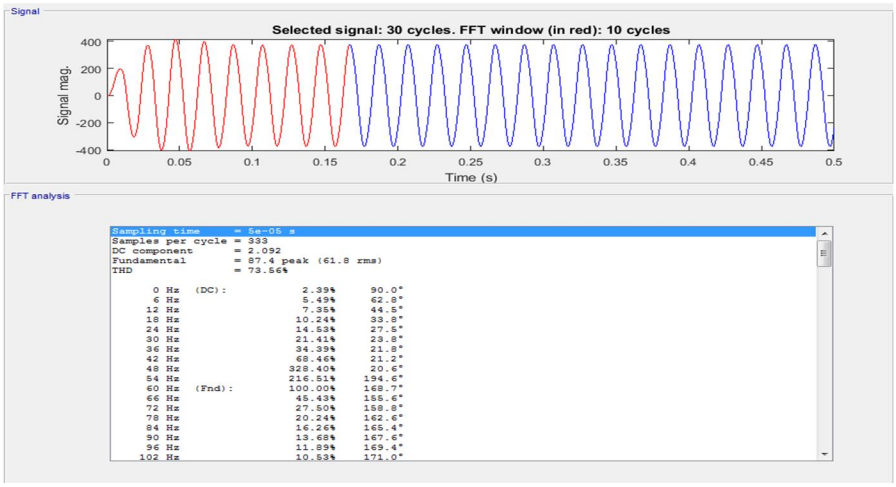


Fig.8.THD of current and voltage is 73.56%

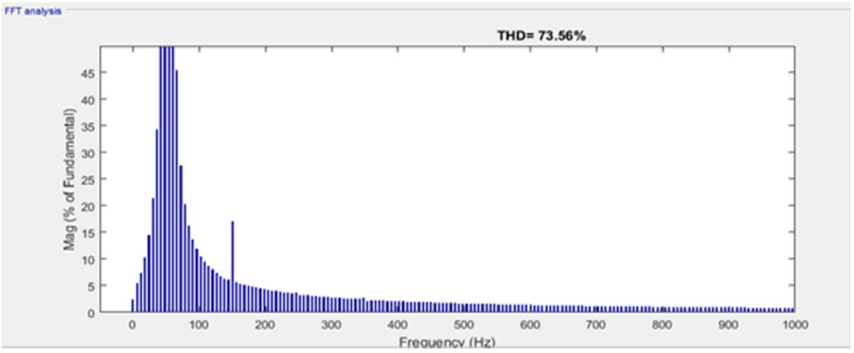


Fig.9.THD Spectrum for voltage and current

VI. SIMULATION RESULTS

In order to verify the operative principle of the of DC-DC H-bridge boost inverter as shown in Fig.10, Pulse generator output simulation is used as a source of inverter. Fig.8 provides a detail of the simulation parameters for the proposed to different frequency and THD of current and voltage is 73.56%. First, we set DC Input Voltage 100v to test properties of proposed inverter. By controlling the shoot-through duty cycle, the dc-link voltage of two qSBI modules is the same. As shown in Fig. 6, the output

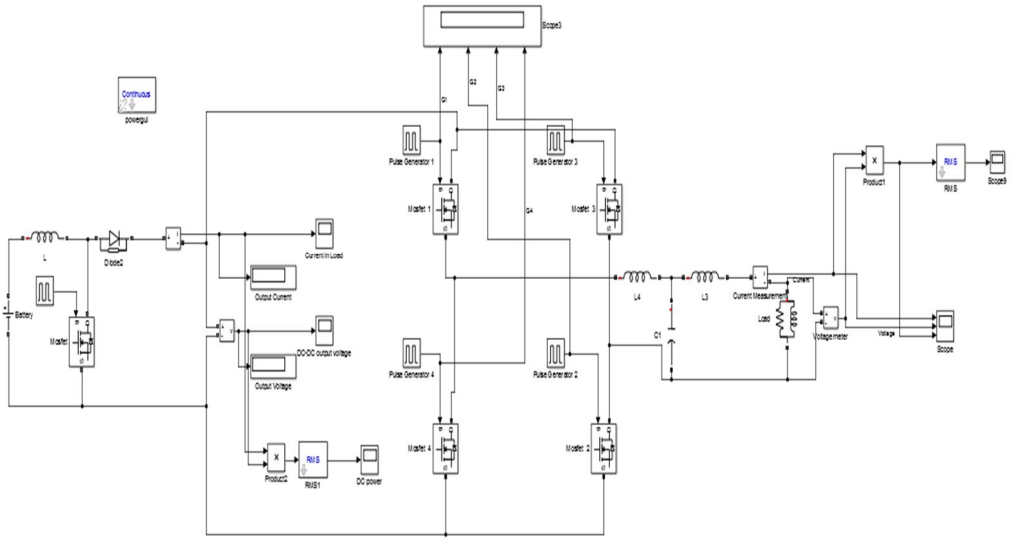


Fig.10.Simulink model of DC-DC boost inverter

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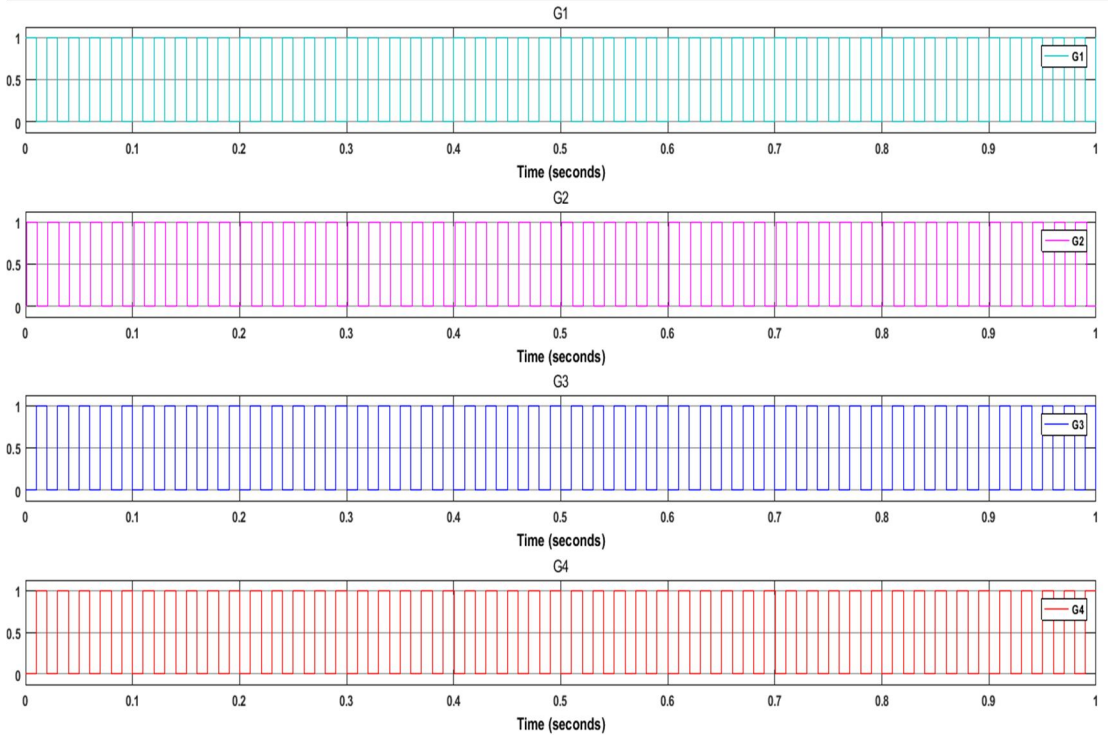


Fig.11.Pulse Generator output for DC-DC Boost inverter

Fig.11 Simulation results for the proposed three-parameter Current (A) Voltage (V) and power (P) output waveform of DC-DC Boost inverter. From top to bottom: input voltage of DC-DC Boost inverter are 100 voltage, output voltage on Simulink Model of H-bridge inverter is 220 voltage. The simulation results for Fig.10.Simulink model of DC-DC boost inverter take a DC Input Voltage 100, and after the H-bridge boost inverter showing result in fig .12 is AC Output Voltage 320. Then shown in Fig.14 we have used 50Hz frequency in THD of Voltage.

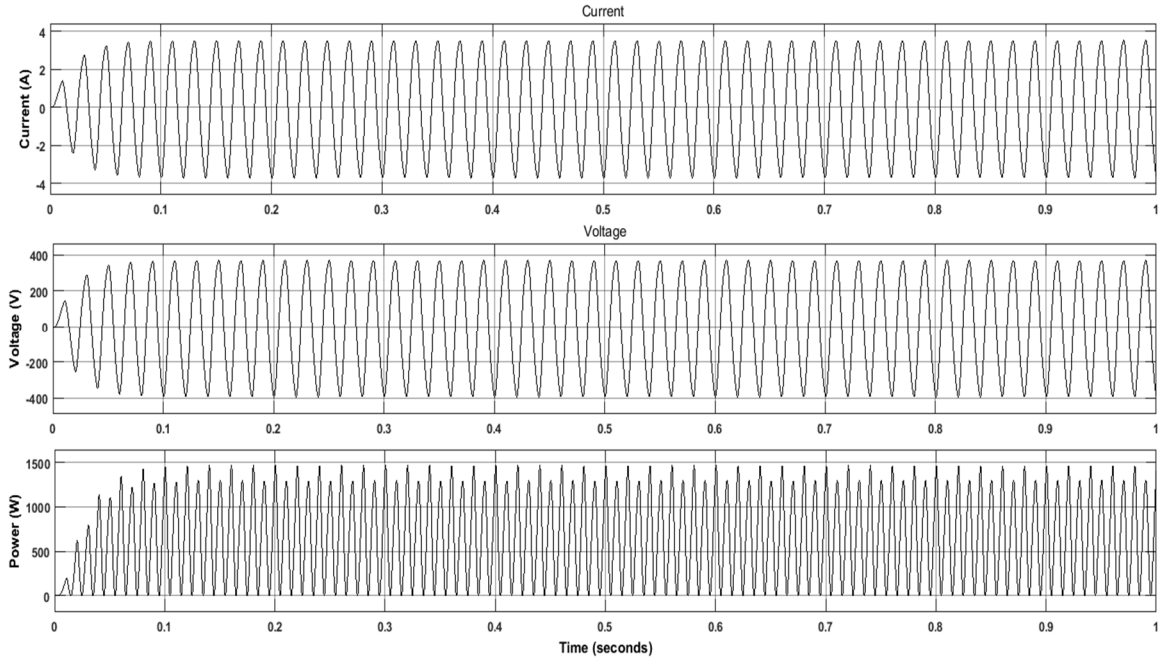


Fig.12.Current Voltage and power output of DC-DC Boost inverter

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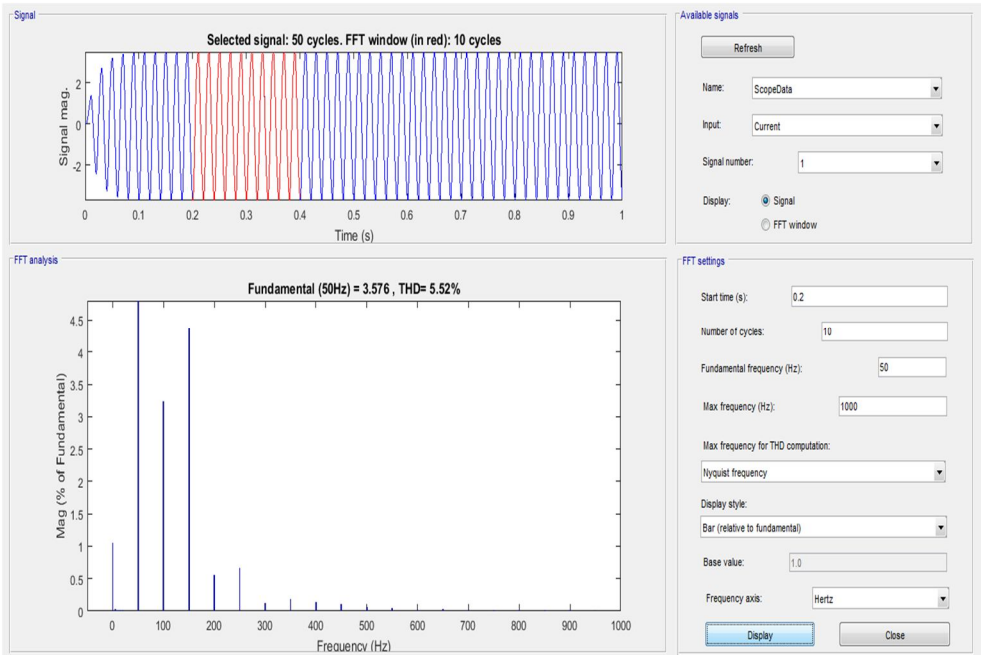


Fig.13.THD of current

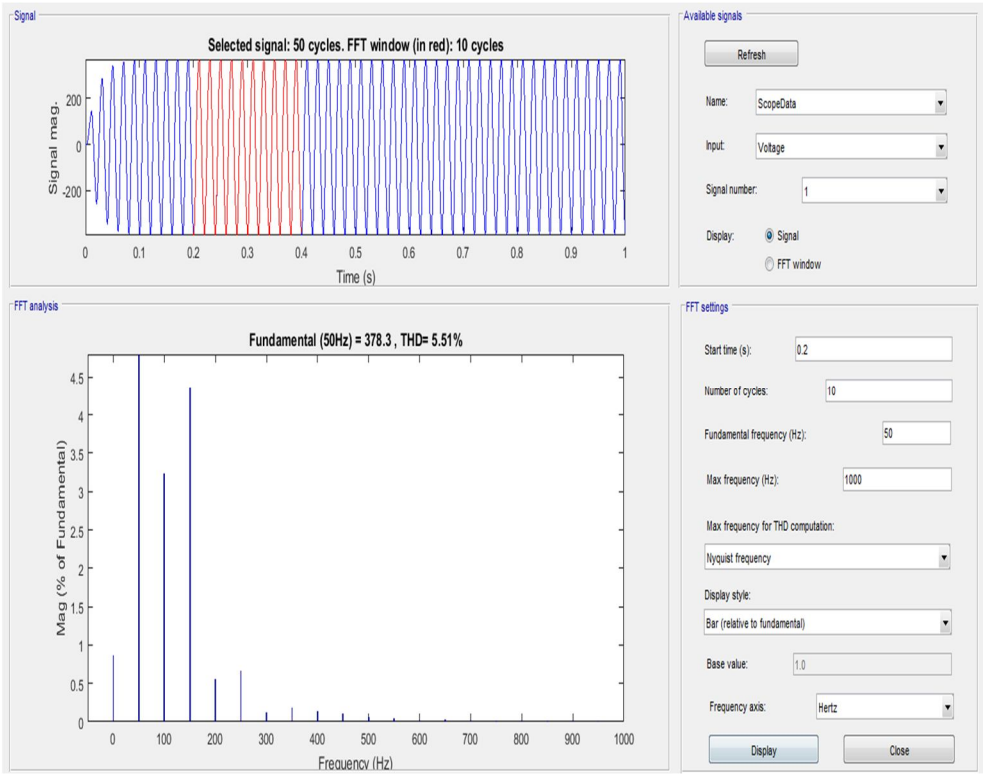


Fig.14.THD of Voltage

VII. CONCLUSION

This paper has proposed the configuration a single level dc-dc boost inverter using H-bridge and source photovoltaic array. Different converter topologies, of a single level-level inverter have been simulated using — Cascade H-bridge inverter Technique. The THD of output voltage waveform was found to be very nominal for all but cascade have little bit high value compare to other. The proposed inverter can boost voltage with THD of Voltage is 5.51%.it is almost near about minimum error. As the level of output wave increases as the THD increases, the filtering problem also decreases. Theoretical results were validated by simulations

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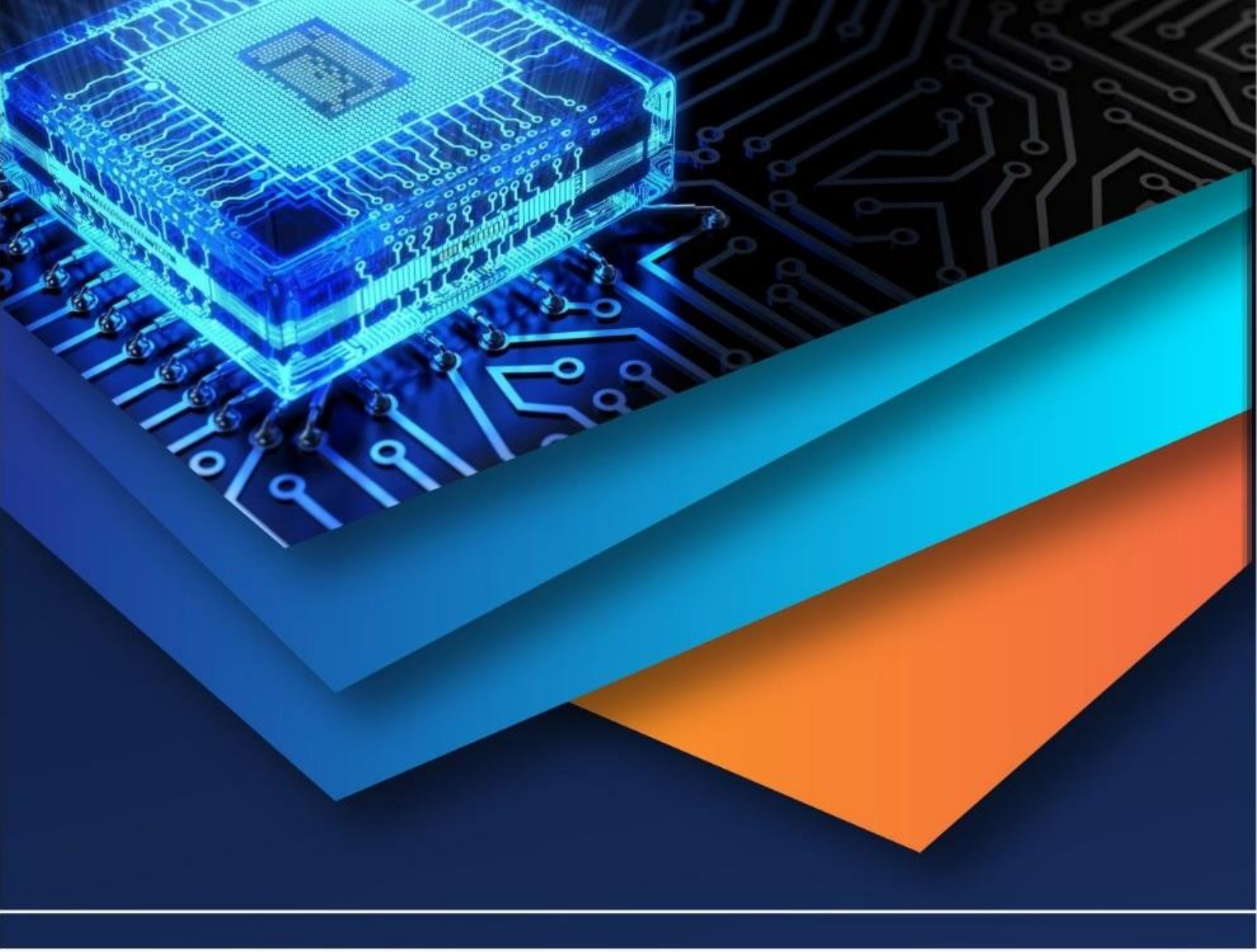
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