DESIGN AND IMPLEMENTATION OF SINGLE PHASE INVERTER

PROF. A. N. WADEKAR,
Depertment of Electrical Engineering, SKN Sinhgad College Of Engineering, Pandharpur, Maharashtra
abhijitwadekar69@gmai.com

J B BANDGAR,
Depertment of Electrical Engineering, SKN Sinhgad College Of Engineering, Pandharpur, Maharashtra
bandgarjayshri3@gmail.com

S V JADHAV
Depertment of Electrical Engineering, SKN Sinhgad College Of Engineering, Pandharpur, Maharashtra
swapnalij1996@gmail.com

U .S MANE,
Depertment of Electrical Engineering, SKN Sinhgad College Of Engineering, Pandharpur, Maharashtra
ulkamane@gmail.com

H R SHAIKH
Depertment of Electrical Engineering, SKN Sinhgad College Of Engineering, Pandharpur, Maharashtra
hinashaikh990@gmail.com

ABSTRACT
Now a day's due to industrialization, there is gap between demand and supply, therefore the need of electricity is increased and we use the electricity efficiently. We cannot store the electricity in AC form, so we store the energy in battery in the form of DC and then it converts into AC using inverter. In that project, we are design and implement the inverter bridge on single phase full and half bridge inverter with R and RL load In that project the PWM method can be used for the generation of the waveforms.
KEYWORDS: IGBT, Diode, IC IR 2110, ICSG 3524, Transistor BC 547, DSO.

I. INTRODUCTION

In this project, focuses on DC to AC power inverters, which aim to efficiently transform a DC power source to a AC source, similarly power that would be available at an electrical wall outlet .Inverter are used for many applications such as domestic, residential and in industries.

The project concerned with the transformation of DC voltage source into AC output the DC to AC inverter on the market. Today there are essentially two different types of AC output generated modified sine wave and pure sine wave. A modified sine wave can be seen as like square wave than sine wave, it passes the DC voltage for particular amounts of time hence the average power and RMS voltage are the same as if it were a sine wave These types of inverters are economical than pure sine wave inverters and therefore these type of inverter can be purchase selectively.

II. PROPOSED SYSTEM

Power Electronics is the technology related with competent conversion, control and handling of electric power by static means from its available input form into the desired electrical output form. Power electronic converters can be occure wherever there is a necessity to convert the electrical energy form (i.e. converts its voltage, current or frequency). Therefore, their power ranges from some mill watts (as in a mobile phone) to hundreds of megawatts with electronics, electrical quantity like currents and voltage are used to transport information, whereas with power electronics, they sustain power.

An inverter is a circuit which is used for converts a DC quantity into an AC quantity at desired output voltage and frequency. The AC output voltage could be fixed or variable voltage and frequency. This DC to AC conversion can be done either by controlled turn on and turn off devices such as MOSFET, IGBT, and MCT or also used by commutated thyristors, depending on application. The output voltage waveform of an ideal inverter is in sinusoidal form. The voltage waveforms of practical inverter are however, non-sinusoidal it will indicted that certain harmonics are present into the output quantity. For the low and medium power application square wave or quasi-square wave voltage maybe allowed and for high power application sinusoidal waveform are required. The output frequency of an inverter is determined by the rate at which the semiconductor devices are switched on and off by the inverter control circuitry and consequently, an adjustable frequency AC output is readily provided. The switching technique of variable high speed power electronics devices using we can reduce the harmonics content. There are two types of single phase inverters i.e. full bridge inverter and half bridge inverter, which are explained below.

1. **Half Bridge Inverter**: The half bridge inverter is the basic building block of a full bridge inverter. It having two switches and each of its capacitors has an output voltage equal to Vdc/2. In addition, the switches complement each other i.e. if one is switched ON the other one should be in OFF state.
2. **Full Bridge Inverter**: In the full bridge inverter circuit DC to AC conversion is done. It will be obtained by turning ON and OFF the switches in the proper sequence. It has four different operating states which are based on which switches are closed or which is in off state.
3.

III. BLOCK DIAGRAM

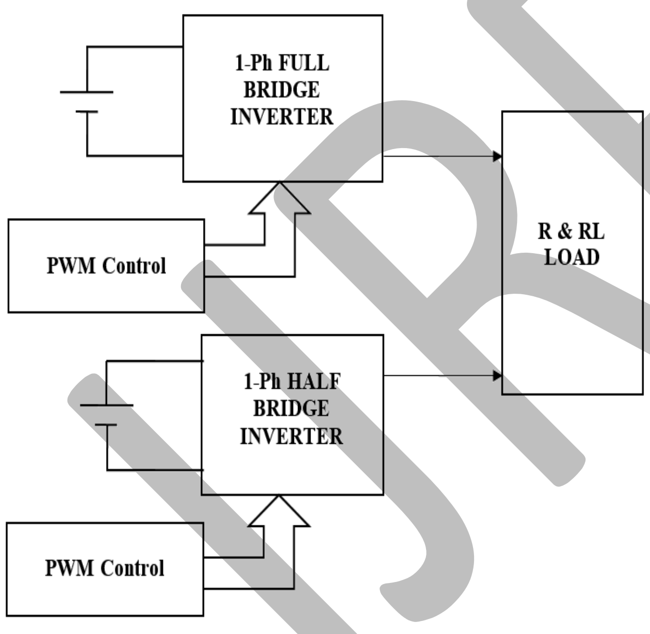


Figure 3.1: Block Diagram of Single Phase Inverter

CIRCUIT DIAGRAM

In case of resistive load, the current waveform follows the voltage waveform. But in case of reactive load current waveform not follows the voltage waveform. The feedback diode operates for the reactive load when the voltage and current are of opposite polarities.

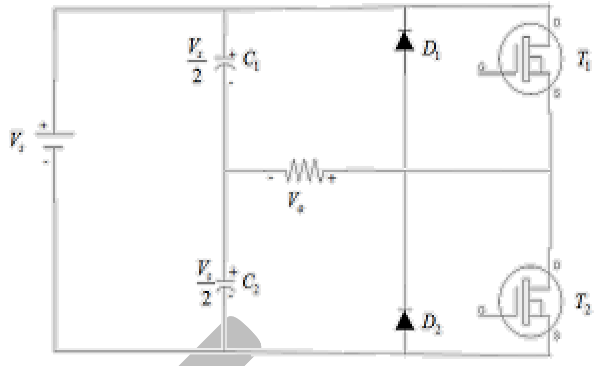


Figure 3.2: Single Phase Half Bridge Inverter

T1 is ON during the positive half cycle of the output voltage, which makes Vout=Vo/2 and T2 is ON during the negative half cycle which makes Vout= -Vo/2. The both switches must operate alternatively otherwise there may be a chance of short circuiting.

Table3.1: Output Parameters Of Half Bridge Inverter

T1	T2	V0
ON	**OFF**	**Vs/2**
OFF	**ON**	**-Vs/2**

It consists of two arms with a two semiconductor switches on both arms with having anti parallel freewheeling diodes for discharging the reverse current. In case of resistive-inductive load, the reverse load current flow through these diodes. These diodes provide an alternate path to inductive current which continue so flow during the Turn OFF condition.

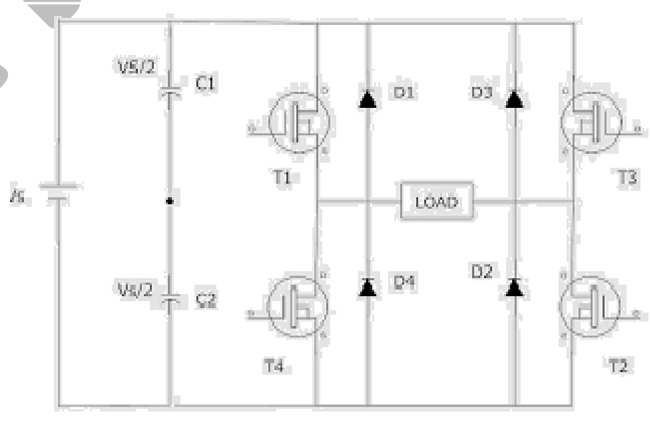


Figure 3.3: Single Phase Full Bridge Inverter

The fig.3.3 shows the single phase full bridge inverter consist of four switches T1, T2, T3 and T4. The switches in each branch is operated alternatively in the sense they are not in same mode (ON /OFF) simultaneously .In practice they are both OFF for short period of time called blanking time, to avoid short circuiting and maximal when shift angle is π.

Table 3.2: Output Parameters of Full Bridge Inverter

T1	T2	T3	T4	VAB	VA	VB
ON	OFF	OFF	ON	+Vs.	+Vs./2	-Vs/2
OFF	ON	ON	OFF	-Vs.	+Vs/2	+Vs/2
ON	OFF	ON	OFF	0	+Vs./2	-Vs/2
OFF	ON	OFF	ON	0	-Vs./2	+Vs/2

The switches T1 and T2 or T3 and T4 should operate in a pair to get the output. These bridges legs are switched such that the output voltage is shifted from one level to another level and hence the change in polarity occurs in voltage waveform. If the shift angle is zero, the output voltage is also zero

A. IGBT (KGT15N120NDH)

An IGBT (insulated gate bipolar transistor) is a solid state device (with fixed parts). An IGBT is a switch that is used in order to allow power flow in the ON state and to stop power flow when it is in the OFF state. An IGBT works by applying voltage to a semiconductor component. [1].

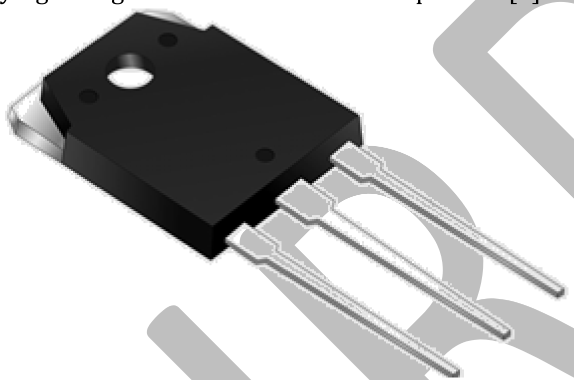


Figure 3.4: IGBT

B. IC SG3524 REGULATING PULSE WITH MODULATOR:

1. Complete Pulse width modulation Power control circuitry.
2. Uncommitted outputs for push pull applications.

C. DSO (DIGITAL STORAGE OSCILLOSCOPE)

A digital storage oscilloscope (DSO) is an oscilloscope which analyses and stores the signal digitally instead of using analogue techniques. It is the most common type of oscilloscope in use because of the advanced storage trigger, measurement and display features .

D. PULSE WIDTH MODULATION-

Various forms of modulation used for communicating information. When a high Frequency signal has amplitude changed in response to a lower frequency signal we have AM (amplitude modulation). When the signal frequency is changed in response to the modulating signal then we have FM (frequency modulation).In these pulse modulation technique compares the carrier and modulation signal and pulse is generated. When communication by pulses was introduced, the amplitude, frequency and pulse width become possible modulation options. The only option is modulation of average conduction time in many power electronic converters where the output voltage can be one of two values.[6]

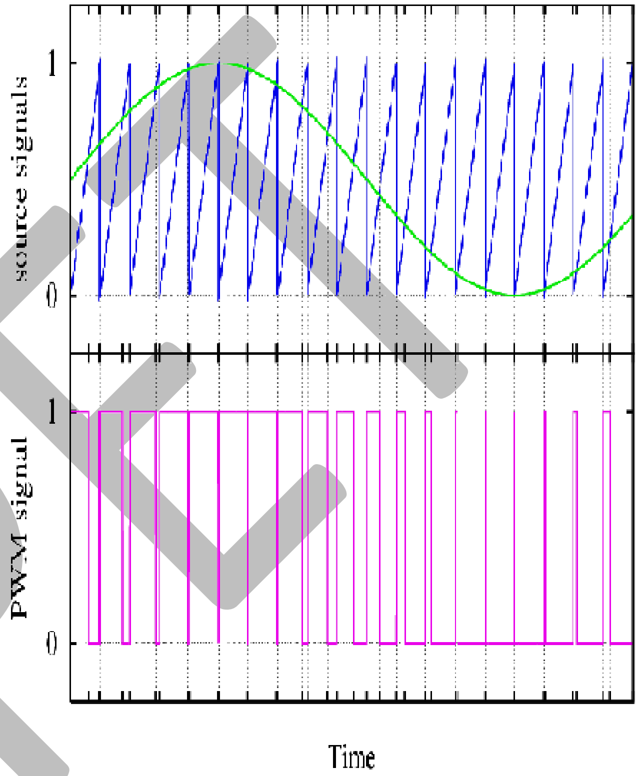


Figure 3.5: Pulse Width Modulation

E. THREE PHASE INVERTER

A three phase output can be obtained from a configuration of 6 power devices and diodes as shown in fig below.

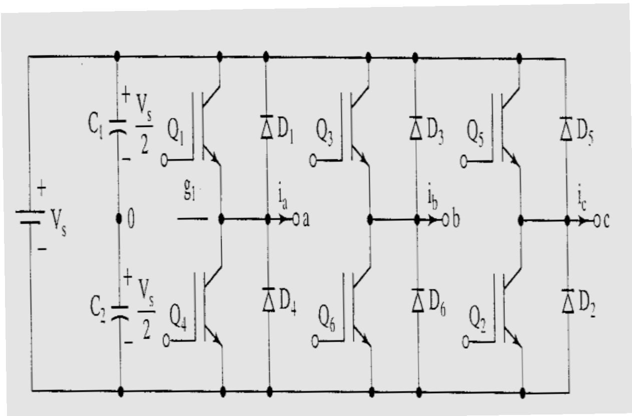


Figure 3.6: 3Phase Full Bridge Inverter with R Load

This configuration is known as three phase bridge configuration. Depending on the control signal applied, to

the transistor three phase inverter of above can operate in one of two possible modes of operation namely,
1] 180 conduction mode.
2] 120 conduction mode.
For operation of the inverter in 180 degree conduction mode is discussed as follows.

The diode D1 to D6 connected across the transistor are called as the feedback diodes. These diodes will return back to the stored energy from the inductive load to the dc supply.

1] 180 Mode of Conduction:

The waveforms for the 180 degree mode of conduction are as shown in figure above .it shows that each transistor is going to conduct for 180 degree at any given instant of time, three power transistor will conducts simultaneously two of which are form one group (upper three or lower three) and which remaining one form the other group.

After every 60 degree one of the conducting transistors is turned off and some other transistor comes in conduction.

Therefore there are six intervals in one cycle of output. Each interval is 60 degree wide.

In 180 degree conduction mode there is conduction of diodes upper side of two diodes and lower side one diode and vice versa .Due to the three phase nature output voltage we will get phase and line voltage waveform at the output of inverter. The output of three phase inverter can be carried out six interval.

PHASE VOLTAGE OF 180 DEGREE CONDUCTION:

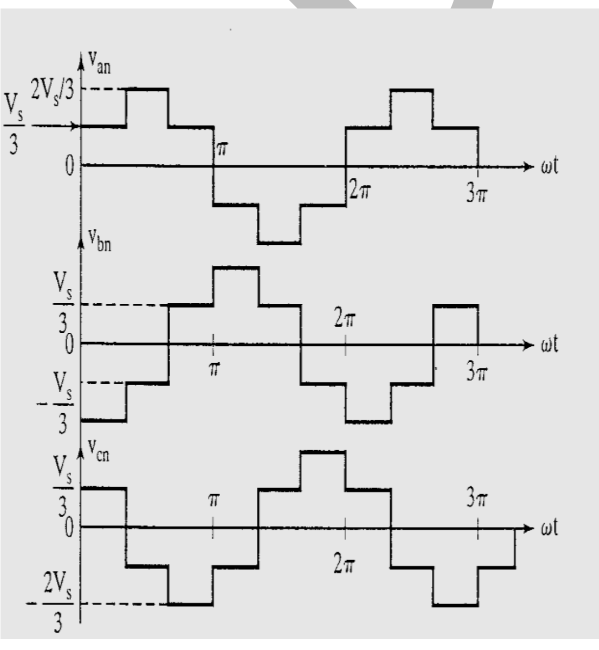


Figure 3.7: Phase Voltage Waveform of 180 Degree Conduction

WAVEFORM OF 180 DEGREE CONDUCTION:

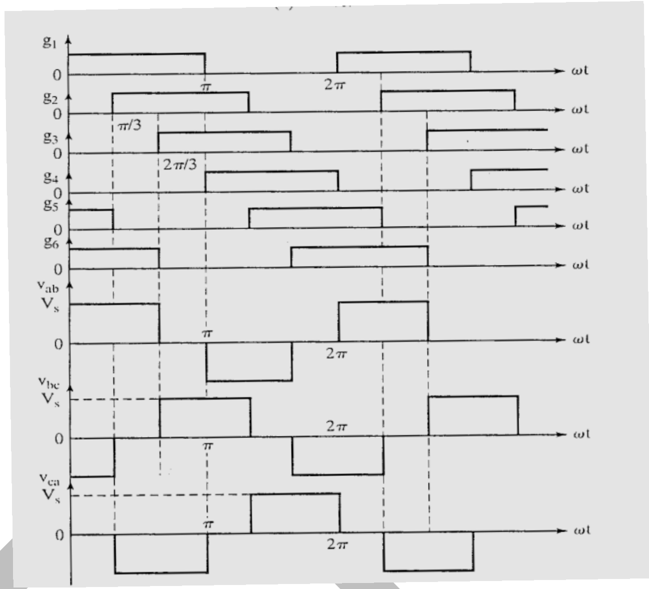


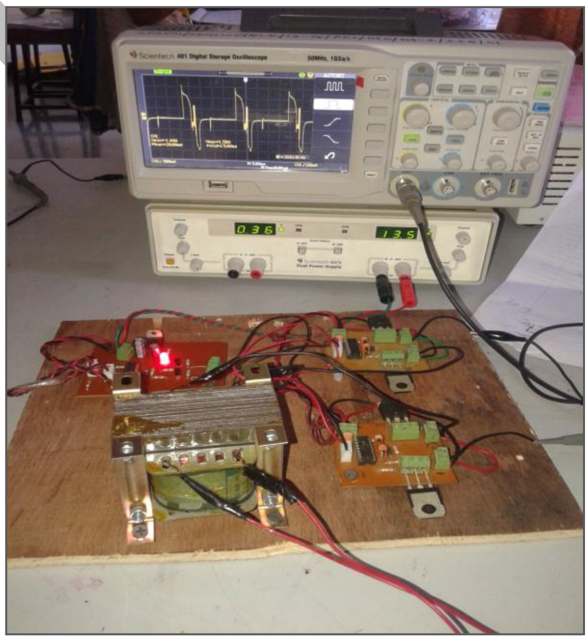
Figure7: Line Voltage Waveform of 180 degree conduction

IV. RESULT

In this project, by using Pulse Width Modulation we are obtained the output voltage waveform of single phase Full Bridge with R and RL load and single phase half bridge with R and RL load. And also measure the voltage, frequency and current

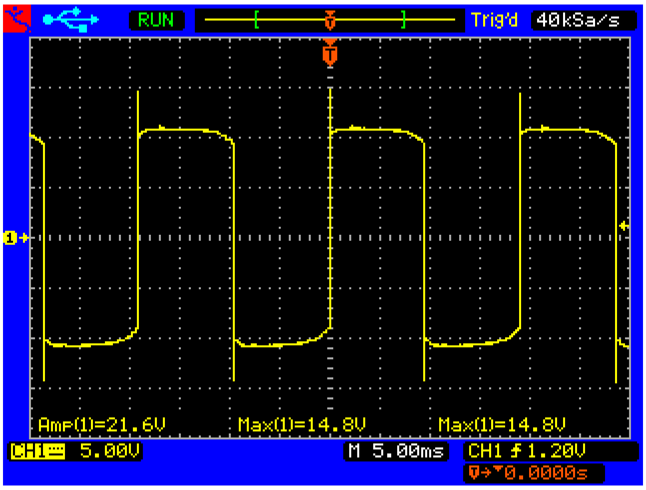
EXPERIMENTAL SETUP:

Photograph 5.1: PWM Waveform



Photograph 5.2: Waveform of Full Bridge with R Load

OUTPUT WAVEFORM OF FULL BRIDGE WITH R LOAD:



Photograph 5.3: Waveform of Full Bridge with RL Load

V. CONCLUSION

With the help of single phase full bridge &half bridge inverter with RL and R load we see the output waveform of half bridge as well as full bridge inverter. And we observes the difference between both output waveforms.

REFERENCES

1] Shubhada Doifode, Subroto Dutt, Rahul Shende " Role of Switch in Multilevel Inverter Designing" peer reviewed international journal

2] 1a.Mahesh Kumar, 2dr.B.Anantha Reddy, 3b.Ramu "Design Of Fast Switching IGBT Gate Driver For High Rated Modules" American International Journal

3] Madhuri R. Patil, Prof.Devidas D.Dighe, "Single Phase Inverter Technique review" International Research Journal

4] L Li, D Crazkowski, P Pillay, Y. Liu "Multilevel Selective Harmonic Elimination PWM Technique in Series Connected Voltage Inverters", IEEE Transactions On Industry Applications

5] A. Tahri, A. Draou and M. Ermis, "A Comparative Study of PWM Control Techniques for Multilevel Cascaded Inverters," Applied Power Electronics Laboratory, Department of Electrotechnics, University of Sciences and Technology

6] N.A. Rahim (Member IEEE), E.A.Mahrous, K.M.Sor(Senior Member IEEE), "Modeling And Simulation of Linear Generator PWM Multilevel Inverter", National Power and Energy Conference (PECon) 2003 Proceedings , Malaysia