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Harmonic Elimination In Three Phase PWM Inverter By THIPWM

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Abstract— This paper present internal control method, i.e. SPWM technique for the IGBT based inverter that can rely on a smaller harmonic with smoother voltage, but on the other hand it has more components and is more complex to control. Mainly inverter converts AC to DC power at a required voltage& frequency. It also minimizes the harmonic distortion at the inverter output. Analysis and design are done by Simulink software to verifying results.

Keywords—MATLAB, 3RDHarmonic SPWM,IGBT.

1. INTRODUCTION

Three phase inverter is mainly used to convert AC power to DC power at desired voltage and frequency [1]. In this, we use the force commutated technique to provide an independent pulse to switch off any power device .we can use "IGBT" because of supporting bipolar voltage, high switching frequency, fully controlled switch (during turn-on and turn-off) and voltage range up to 1200V, 300A respectively. In this type, we have to maintain the gain of the inverter at a constant value which can use by various techniques i.e. 1. Variable frequency method. [2]

2. PULSE WIDTH MODULATION

Variable frequency method: In the variable frequency method, the chopping frequency has to be varied over a wide range for the control of output voltage so the filter is designed for such wide frequency variation, therefore, it's quite difficult for the control of alpha. So there is a possibility of interference with signalling and telephone line. In these type limitations, we can't use this type of method.

Pulse Width Modulation: This type of method is simpler and better than variable frequency method. But in this case, Ton cannot be reduced to zero for the commutation circuit used in the chopper.

3. 3RD HARMONIC INJECTION PULSE WIDTH MODULATION

SPWM technique is easy to understand, but it does not fully utilized the DC supply voltage, 3rd harmonic Injection Pulse Width Modulation technique is used. The idea of 3rd harmonic injection is based on the fact that of a 3phase inverter bridge feeding a 3phase AC load does not provide a zero sequence component of load current. In the case of delta connected load, there is no confusion, but in the case of star connected load three phases are connected and neutral point is floating for a balanced load. The floating neutral point has the advantage that there is no zero sequence component. In this technique, a suitable amount of third harmonic signal is added to the sinusoidal modulating signal of fundamental frequency. Now the resultant waveform is high frequency triangular carrier waveform. The carrier frequency waveform is higher tahan the modulating frequency signal. The compositon of pole voltage is same as the fundamental and third harmonic as in the modifying signal. The advantage of adding small amount of third harmonic in the modulating waveform is that it bring, down the peak magnitude of the resultant modulating waveform. The modifying modulating waveform is more flat topped than its fundamental component.

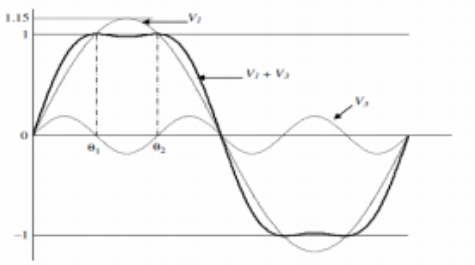


Figure 1:

In shown in the figure, if we assume the signal frequency of 2π then the value of reference signal have two maixma at t= $\pi/3$ and 2 $\pi/3$ which is equal to 1. The reference signal consist of fundamental and third harmonic frequency component has their following equation given below:

$V_a = V_{(1max)}Sin(\omega t) + V_{(3\ max)}\ sin(3\omega t)$ …….(1)

$V_b = V_{(1max)}Sin(\omega t-2\pi/3) + V_{(3\ max)}\ sin(3\omega t$ ……(2)

$V_c = V_{(1max)}Sin(\omega t+2\pi/3) + V_{(3\ max)}\ sin(3\omega t)$ ……(3)

4. INVERTER

Power inverters are devices which can convert DC power into that of AC. Inverters can be broadly classified into two types based on their operation:

1. Voltage Source Inverters (VSI)[5]
2. Current Source Inverters (CSI)

A current source inverter is fed with adjustable current from a DC source of high impedance. In a CSI fed with a stiff current source, output current waves are not affected by the load. Voltage Source Inverters is one in which the DC source has small or negligible impedance. Other words VSI has stiff DC voltage source and a capacitor parallel across at its input terminals. A CSI does not require any feedback diodes whereas these are required in VSI. The purpose of a DC/AC power inverter is typically to take DC power supplied by a battery, such as a 12-volt car battery, and transform it into a 120 volt AC power source operating at 60 Hz, emulating the power available at an ordinary household electrical outlet.

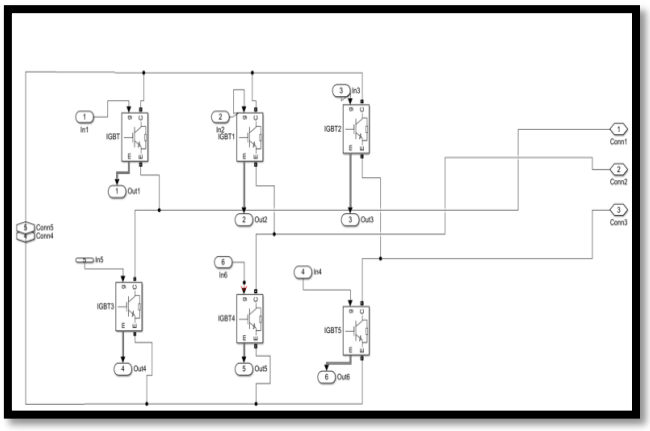


Figure 2: Three Phase Inverter Circuit

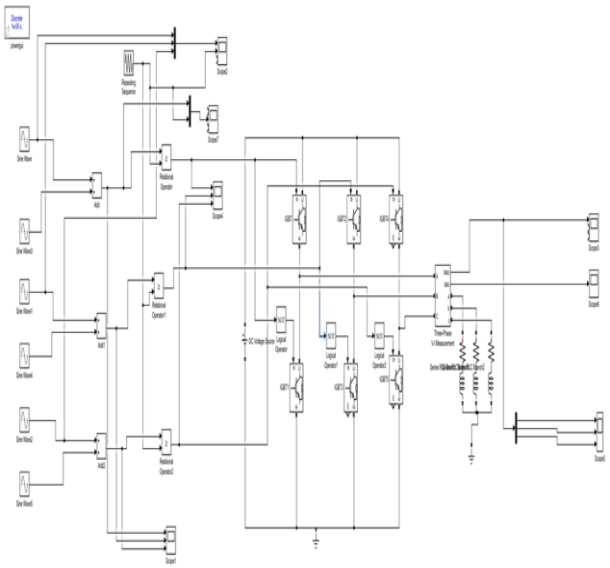


Figure 3: Complete Circuit diagram of THIPWM Inverter

5. SIMULATION RESULT

Here we developed a DC to AC inverter in simulation Matlab with a three-phase PWM inverter by controlling the magnitude of voltage and frequency. For controlling the output voltage we use sine pulse width modulation method, in which output voltage is controlled by the modulation index (By changing the modulation index from under modulation to overmodulation). In this paper, we check the effect of modulation
index on the THD (total harmonic distortion) of current/voltage through the FFT of the powerful block which is shown by the different graphs and resulting value's. The Identical magnitudes and phase difference of 120 degrees between them at all operating frequencies. Generating a balanced three-phase sinusoidal waveform of controllable magnitude and frequency is a pretty difficult task for an analogue circuit and hence a mixed analogue and digital circuit is often preferred. Simulation results are obtained using the MATLAB / Simulink environment for the effectiveness of the study.

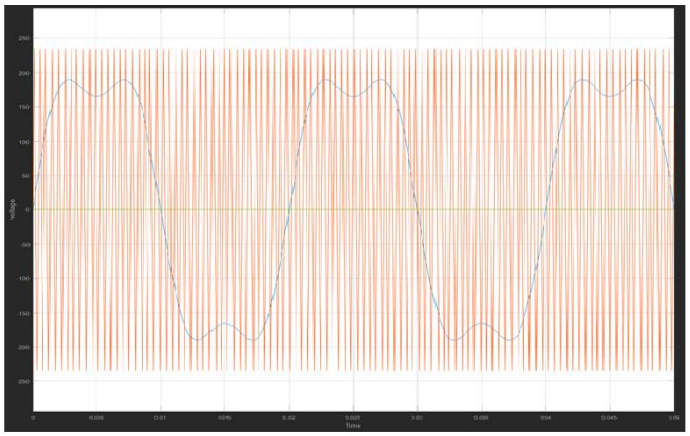


Figure 4: Simulation results obtained for three-phase modulating waveform and phase shifted carrier wave

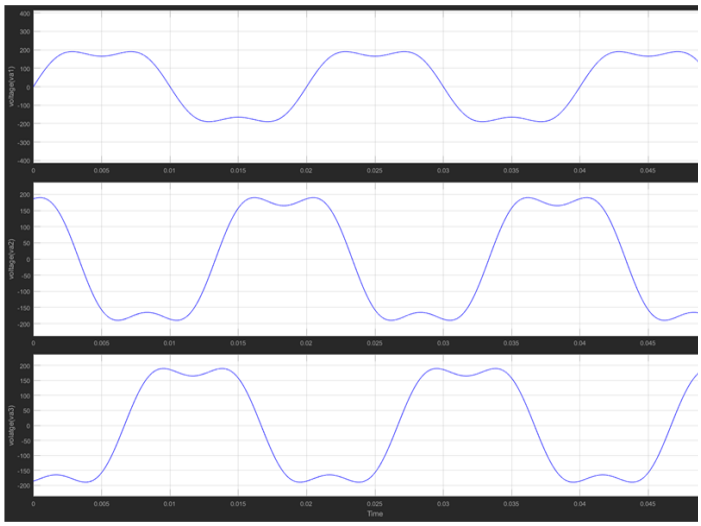


Figure 5 : Simulation results for three phase 3rd harmonic + sine wave

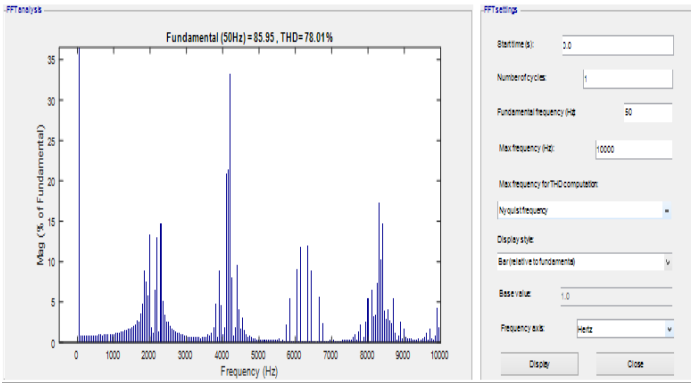


Figure 6 : Harmonic analysis of pwm wave

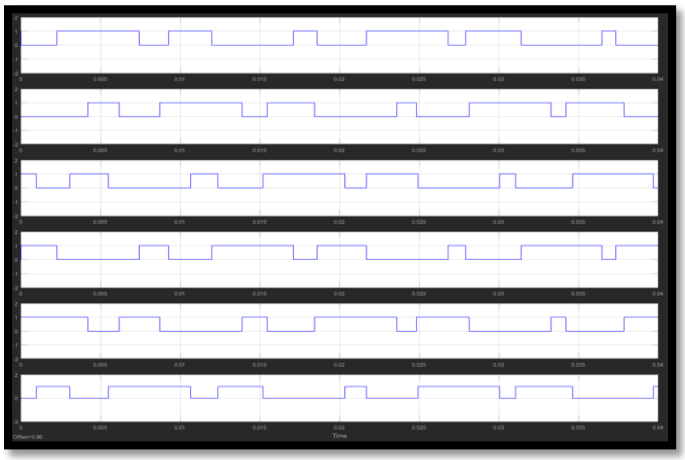
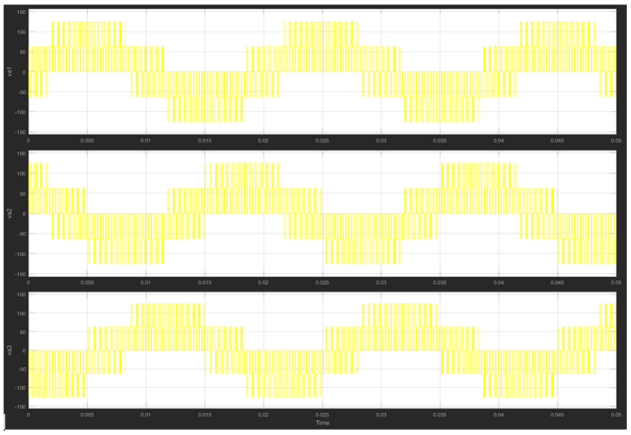
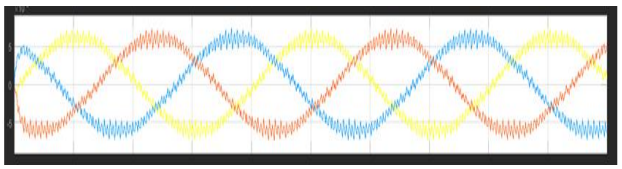


Figure 7: Simulation results obtained Corresponding to Gate Pulse obtained for inverter



(a)



(b)

Figure 7: (a) Voltage with SPWM obtained with R Load in Simulink (b) current obtained with RL load

6. CONCLUSION

The main aim of this paper is to reduce the THD of output current/voltage by varying the modulation index between 0.1 to 1. Then we see that we have to fulfil our aim at great extent, mean's that by increasing the modulation index from 0.1 to1 the value of THD is minimized. The basic drawbacks of the SPWM are not the ideal use of the DC bus voltage and the non-existent interaction between the three-phase result in a

superfluous change of switching state and also increasing the semiconductor losses.

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