

MULTILEVEL INVERTER USING SPWM REDUCTION OF THD BY MULTI-CARRIER

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ABSTRACT: The various number of pulses generate by SPWM technique in this technique sine wave compared with multi-carrier wave and pulse obtain. In this technique total harmonic distortion will be reduce significantly. In this work another topology for seven level inverter using five switches and in this model multi-carrier SPWM use also so, THD reduced as possible. This proposed work of dissertation simulated in MATLAB SIMULINK 2010a.

1.1 Introduction of Multilevel Inverter

The inverter does this through a complex process of electrical adjustment. From this process, AC electric power is produced. This form of electricity can be used to power an electric light, a microwave oven, or some other electric machine and other domestic purpose.

Types

- Sine wave inverters produce good-quality AC power. They are expensive.
- A modified sine wave inverter produces a lower quality of AC power, with strong power system harmonics but is cheaper. Various modulation strategies are used in cascaded multilevel inverters to reduce the harmonic contents.

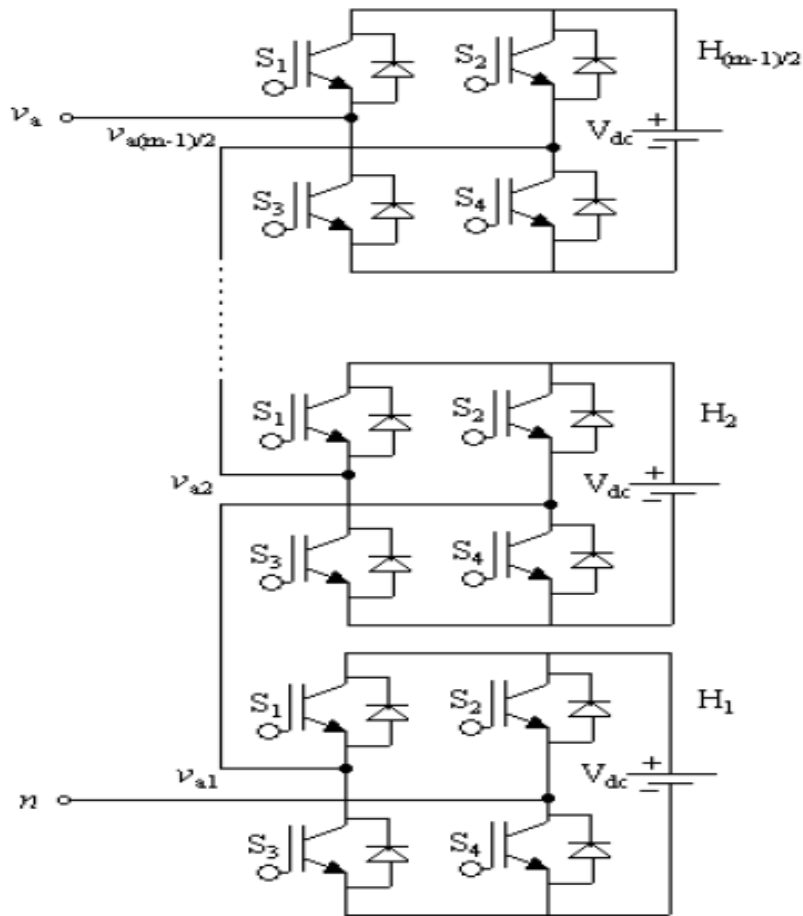


Figure 1: Configuration of Single phase Cascaded multilevel inverter

These control schemes are often used in variable-frequency motor control inverters because they allow a wide range of output voltage and frequency adjustment while also improving the quality of the waveform.

Some of the salient features of the multilevel inverters are:

- The multilevel inverters can acquire the voltage and current with low THD.
- Efficiency of the inverter depends upon the switching frequency.
- Common mode voltages are reduced and hence the stresses on the motor bearings are reduced.

1.2 Purposed topology of multilevel Inverter: -

In recent day's Multi-level inverter (MLI), technologies become an incredibly main choice in the area of high power medium voltage energy control. Though multilevel inverter has a number of advantages, it has drawbacks in the vein of higher levels because of using more number of semiconductor switches.

Proposed 11-level 7-Switch Topology:

The proposed 11 level MLI, circuit thus obtained is the simplest design compared to conventional and all other existing topologies. It consists of six dc sources of 11-levels, for 9-level consist five dc sources and so on. The configuration of 11-level 7-switch topology inverter.

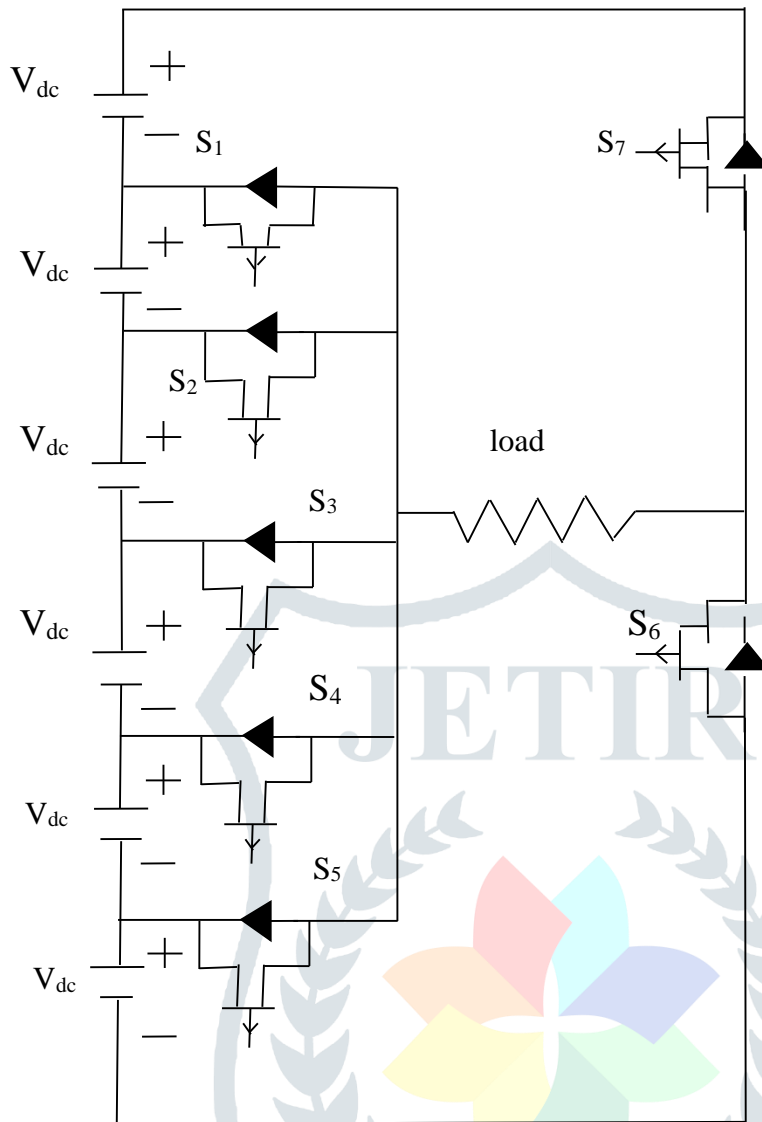


Fig 2: Seven-switch topology of 11-level MLI

1.3 TYPES OF CARRIER BASED SPWM TECHNIQUES: -

Sinusoidal PWM can be classified according to carrier and modulating signals. This work used the intersection of a sine wave with a triangular wave to generate firing pulses. There are many alternative strategies to implement this. They are as given below.

- Phase Opposition Disposition (POD) PWM where the carriers above the zero reference are in phase but shifted by 180° from those carriers below the zero reference.
- Alternative Phase Opposition Disposition (APOD) PWM where each carrier band is shifted by 180° from the adjacent bands.

In Phase Disposition (PD) PWM all the carriers are in phase.

- Phase Shift PWM (PSPWM): all carrier signals have the same amplitude and frequency but they are phase shifted by 90 degrees to each other.
- Carrier Overlapping PWM (COPWM): all carriers with the same frequency and same peak to peak amplitude are disposed such that the bands they occupy overlap each other.

- Variable Frequency PWM (VFPWM): carriers have the variable frequency and same amplitude each other.

1.4 Result and Discussion

In the result lowest THD obtained, as we increase level of voltage of multi level inverter. So there are some results of THD and switching pulses waveforms are shown here, output waveform also shown. Here output waveforms are shown one by one in increasing order of multi-level in inverter. Firstly, 7-level 5-switch inverter and 11-level inverter output waveform presented here. Output of 11-level 7-switch inverter:-

This figure present output waveform reduced switch, using only 7-switches for 11-level inverter.

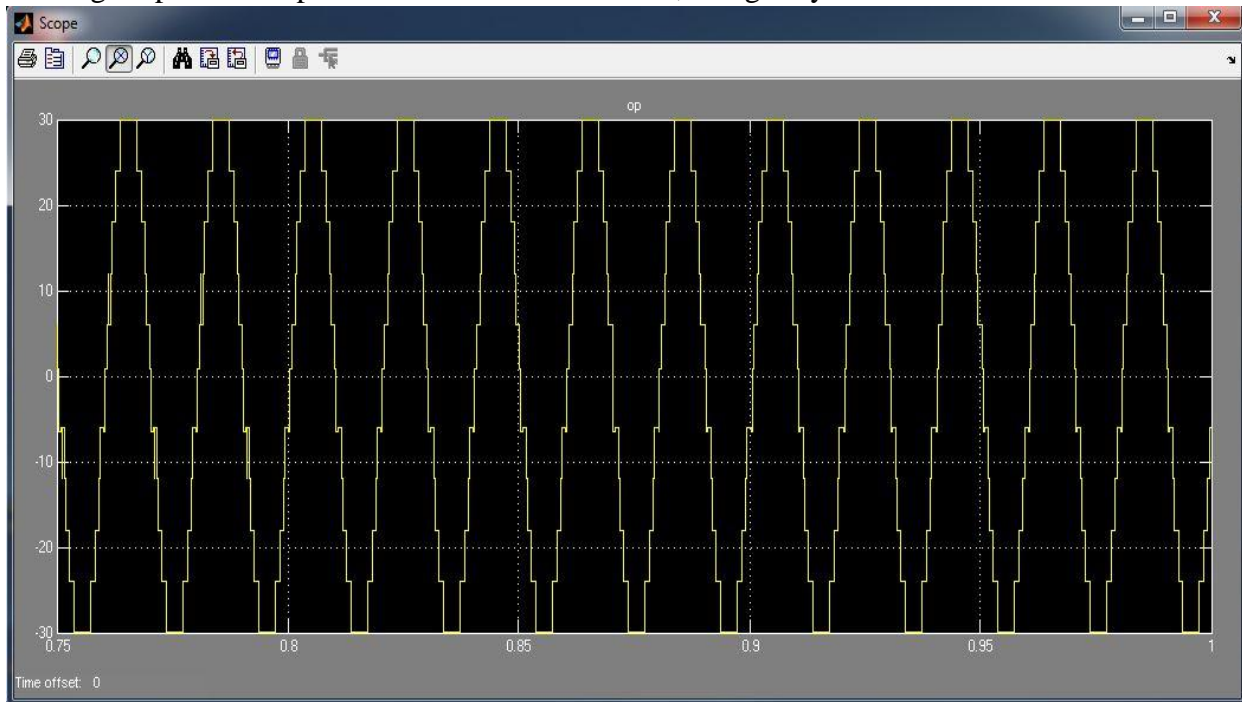


FIGURE 3: Output reduced THD waveform of 11-level inverter.

FFT Analysis Open the FFT Analysis Tool dialog box to perform Fourier analysis of signals stored in a Structure with Time format. FFT Analysis tool is described in Performing Harmonic Analysis Using the FFT Tool. So, the resultant FFT waveform is;

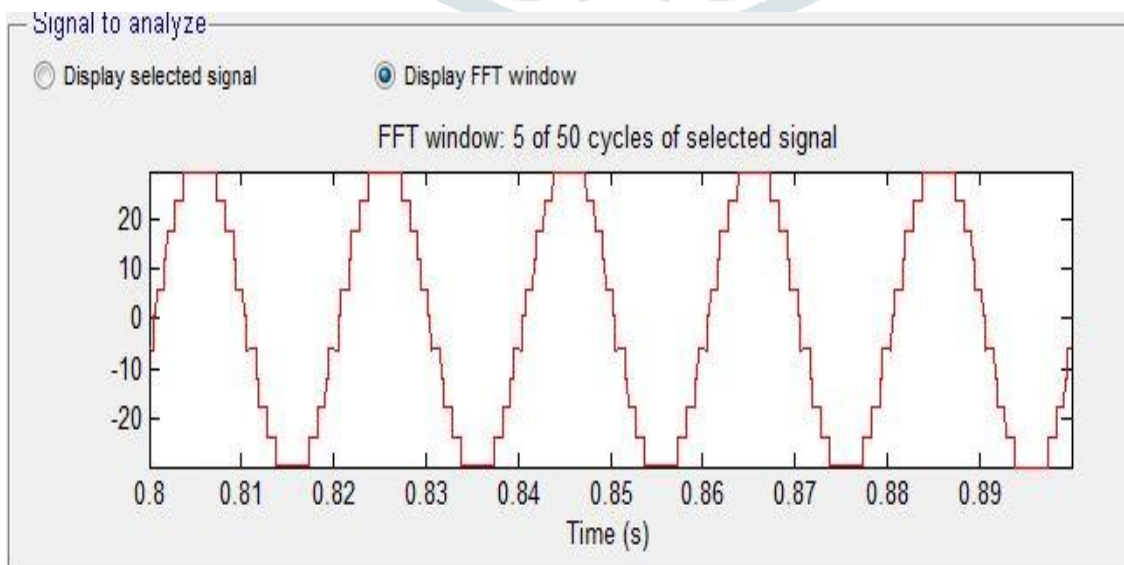


FIGURE 4: FFT analysis for frequency analysis of 11-level inverter.

THD analysis of 11-level inverter output waveform:- The below figure shows that percentage of THD content in fundamental frequency.

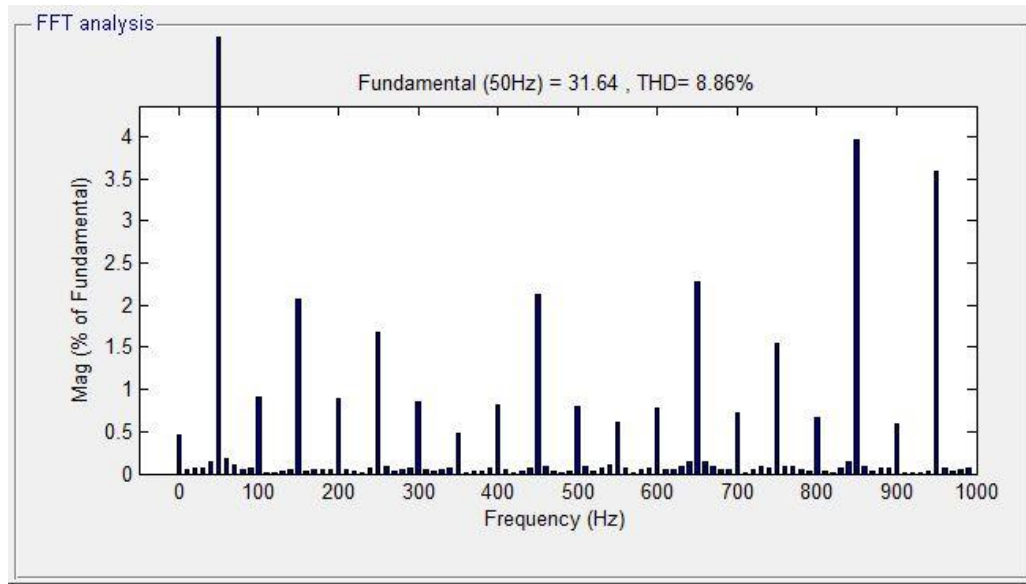


FIGURE 4: Output THD percentage of 11-level MLI

Now, the further THD analysis in 7-level using also reduced switch topology, only 5-switch, output waveforms are also shown as 11-level inverter. So, that switching losses are reduced significantly because of more number of switches required in other topologies like, cascaded topology. The 7-level 5-switch inverter output waveform is;

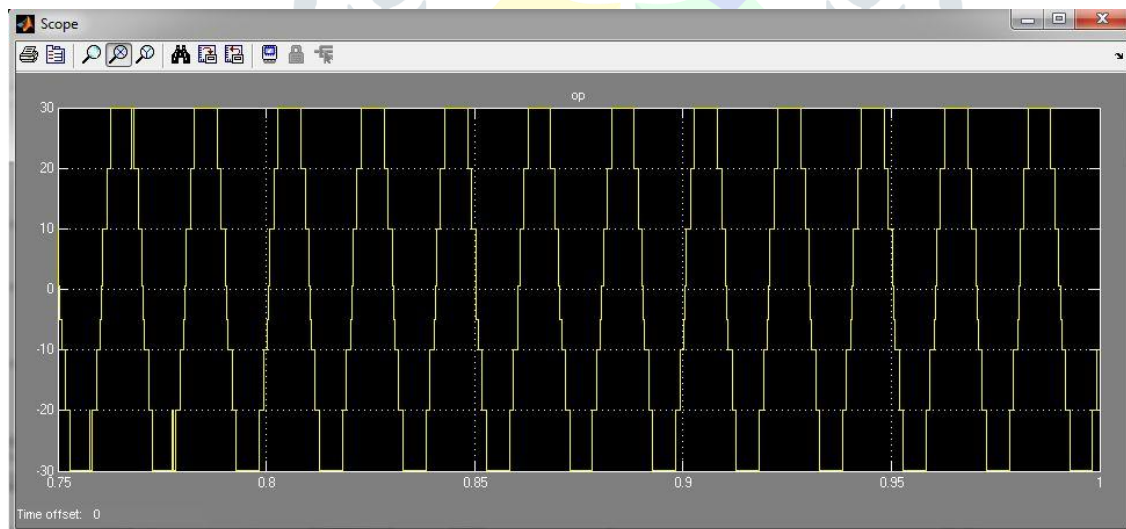


FIGURE 5: Output THD waveform for 7-level 5-switch inverter.

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