SIMULATION OF SINUSOIDAL PULSE WIDTH MODULATION BASED THREE PHASE CASCADED SEVEN LEVEL AND NINE LEVEL INVERTER

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ABSTRACT: ***The emergence of Multilevel has been in increase since the last decade. These types of converters are suitable in medium voltage & high power application due to their ability to synthesize waveforms with better harmonic spectrum. This paper present scheme adopting the Multi carrier Pulse width modulation concept. The MCPWM Cascaded Multilevel inverter strategy reduced Total harmonic distortion. Three phase seven levels and nine level cascaded inverter is used to explain the method. The method can be easily extended to a n-level inverter. The cascaded inverter is subjected to a new modulation scheme, which uses multiple modulating signals with a single carrier.***

Index Terms: Multilevel inverter, Multicarrier Pulse width modulation, Total harmonic distortion.

I. INTRODUCTION

Power Electronics devices contribute with important part of harmonics in all kind of applications, such as power rectifiers, thyristor converters, and static var compensators (SVC). On the other hand, the PWM techniques used today to control modern static converters such as machine drives, power factor compensators or active power filters, do not give perfect waveforms, which strongly depend on switching frequency of the power semiconductors. Normally, voltage (or current in dual devices) moves to discrete values, forcing the design of machines with good isolation, and sometimes loads with inductances in excess of the required value. In other words, neither voltage nor current are as expected. This also means harmonic contamination, additional power losses, and high frequency noise that can affect the controllers. All these reasons have generated many research works on the topic of PWM modulation the concept of multilevel inverter has been introduced since 1975. The term multilevel began with the three-level converter. Subsequently, several multilevel inverter topologies have been developed. However, the elementary concept of a multilevel inverter to achieve higher power is to use a series of power semiconductor switches with several lower voltage dc sources to perform the power conversion by synthesizing a staircase voltage waveform. Capacitors, batteries, and renewable energy voltage sources can be used as the multiple dc voltage sources. The commutation of the power switches aggregate these multiple dc sources in order to achieve high voltage at the output; however, the rated voltage of the power semiconductor switches depends only upon the rating of the dc voltage sources to which they are connected.

II. MULTICARRIER PULSE WIDTH MODULATION

The most popular and easiest technique to implement uses several triangle carrier signals and one reference, or modulation, signal per phase. For an m-level inverter, m-1 carriers with the same frequency f_c and the same amplitude A_c are disposed such that the bands they occupy are contiguous. The reference waveform has peak-to-peak amplitude A_m, a frequency f_m, and its zero centered in the middle of the carrier set. The reference is continuously compared with each of the carrier signals. If the reference is greater than a carrier signal, then the active device corresponding to that carrier is switched on; and if the reference is less than a carrier signal, then the active device corresponding to that carrier is switched off. In multilevel inverters, the amplitude modulation index, m_a, and the frequency ratio, m_f, are defined as

$$m_a = \frac{A_m}{(m-1)\cdot A_c},$$

$$m_f = \frac{f_c}{f_m}.$$

III. EXPERIMENTAL MODEL OF SEVEN LEVEL AND NINE LEVEL INVERTER

For seven level cascaded multilevel inverter reference signal is sinusoidal and carrier signal is triangular wave .
m-1=6 number of carrier wave
m=7;m is number of level
m_a=1.
Frequency of output of inverter is equal to the frequency of reference signal
V_{dc} =25volt

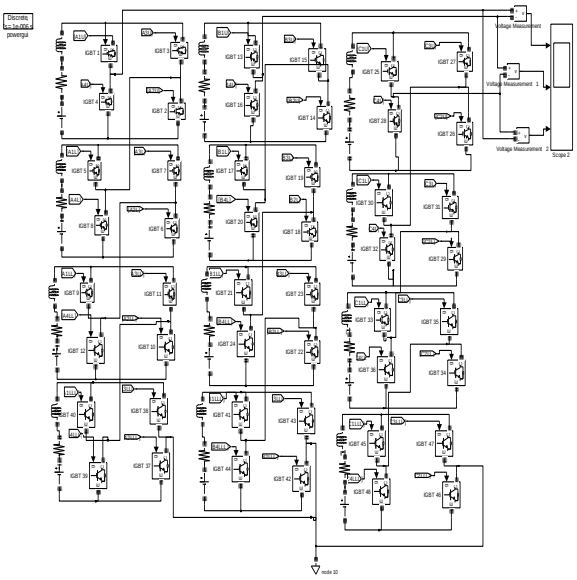

Fig.1 Model of three phases cascaded seven level inverter

For nine level cascaded multilevel inverter reference signal is sinusoidal and number of carrier signal is m-1=8
m=9;m is number of level
m_a =1.
V_{dc}=25volt

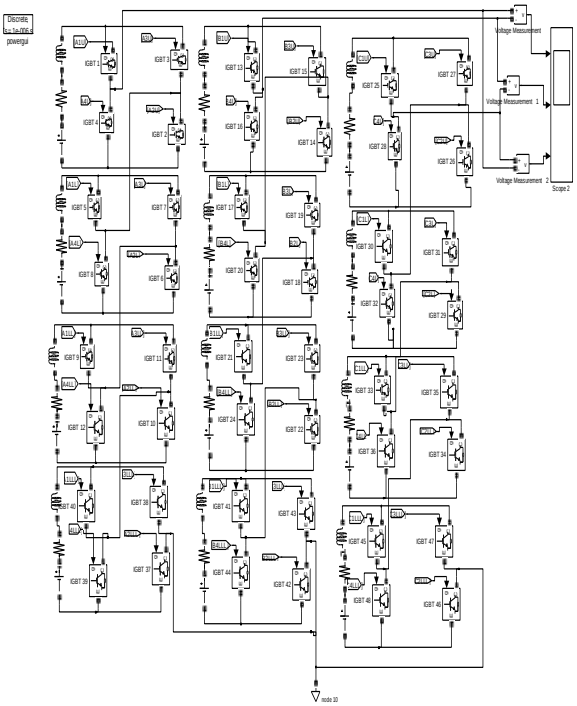

Fig.2 Model of three phase cascaded nine level inverter

IV. RESULT

Simulation of seven level and nine level inverter model is done using MATLAB. Simulation result of models and FFT analysis presented.Fig.3 presents waveform of LINE-LINE voltage and FFT spectrum of seven level inverter. Fig.4 presents waveform of LINE-LINE voltage and FFT spectrum of nine level inverter.

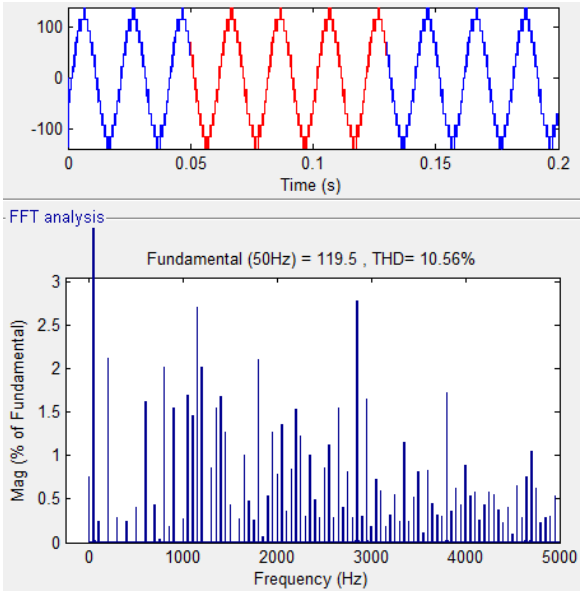

Fig.3 waveform of LINE-LINE voltage of seven level inverter and FFT spectrum of seven level inverter.

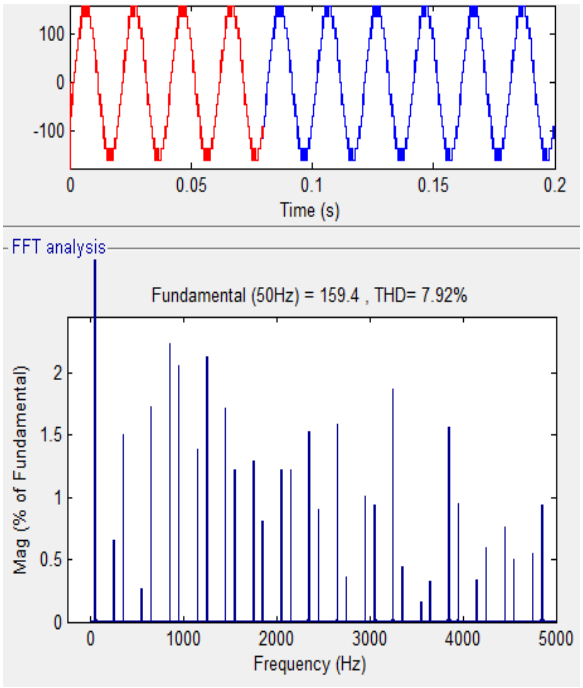

Fig.4 Waveform and FFT analysis of nine level inverter.

V. CONCLUSION

Inverter	THD%
Seven level inverter	10.56%
Nine level inverter	8.96%

The modeling of seven level and nine level is simulated using Simulink. The total harmonic distortion is decreseses when level increases. The simulation result shows that the harmonics have been reduced considerably.

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