COMPARATIVE ANALYSIS OF TOTAL HARMONIC DISTORTION IN VSI FED MULTI-LEVEL INVERTERS

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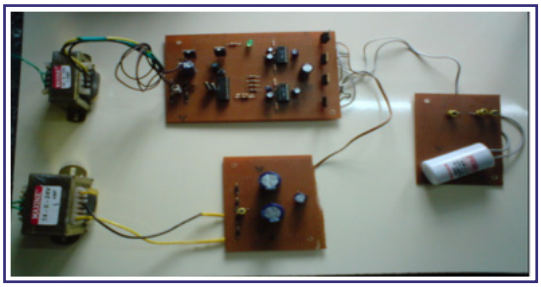
ABSTRACT

Conventional two-level inverter fed induction motor drive system possesses significant quantity of harmonics and makes the induction motor to suffer from severe torque and speed fluctuations. The presence of harmonic also causes Electro-Magnetic Interference (EMI) and motor heating. Large sized filters are required to reduce the magnitude of harmonics, which results in higher cost of the drive system. Multilevel inverters are the most promising and economical option for achieving high-quality output power in high voltage and high power motor drive applications. The system's capacity to handle electricity is increased when the Multilevel inverter structure is used. Higher level of inverters reduces the Total Harmonic Distortion (THD) and overall performance inverter systems.

1. INTRODUCTION

This proposal deals with comparative analysis of 3 level, 5 level, 7 level and 9 level inverter fed induction motor drive systems which are modeled, simulated and successfully implemented in the Power Electronics laboratory. Simulation as well as experimental results of current and voltage THDs are presented. Rotor response and efficiency of various inverter fed induction motor dives systems are also presented. The hardware snap shot of Multi level inverter is shown in figure 1.

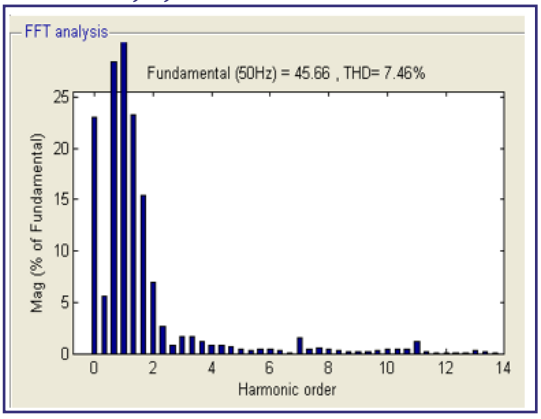
Fig. 1. Hardware snap shot of Multi level inverter



2. HARMONIC ANALYSIS

Figures 2 display FFT spectra for the stator currents of inverter-fed induction motor drive systems with three, five, seven, and nine levels. Table 1 summarizes the current THD simulation and experimental results, whereas Figure 2 displays the current THDs graphically against inverter levels. According to the comparative analysis of THDs, the output waveforms produce more steps as the number of levels rises, creating staircase waveforms and lowering the THD.

Fig. 2: FFT Spectrum for stator current of 3, 5, 7 and 9 level inverter



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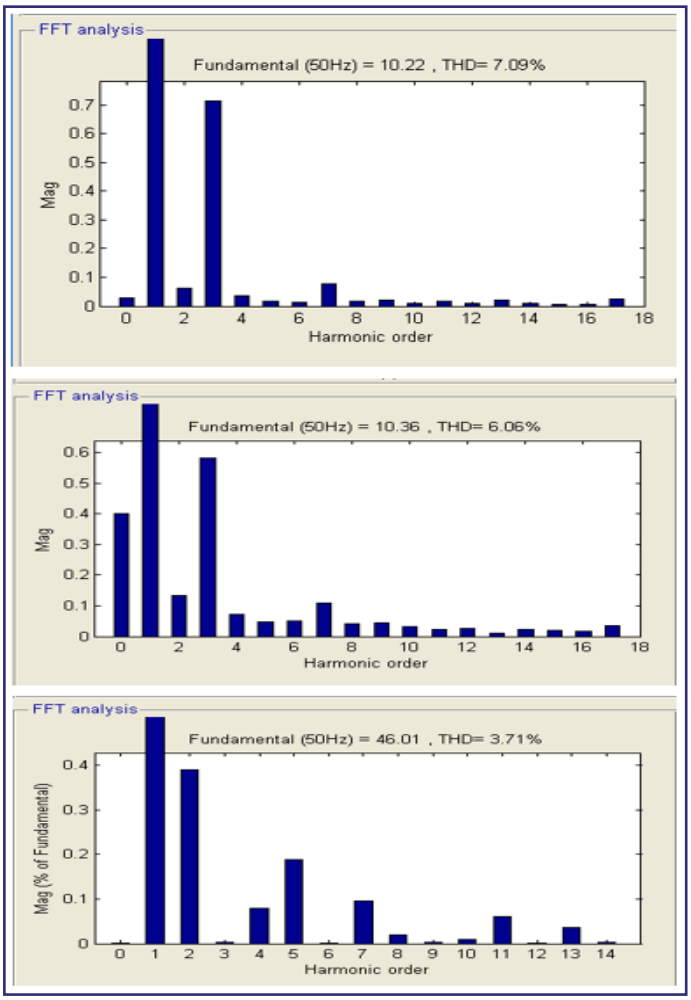
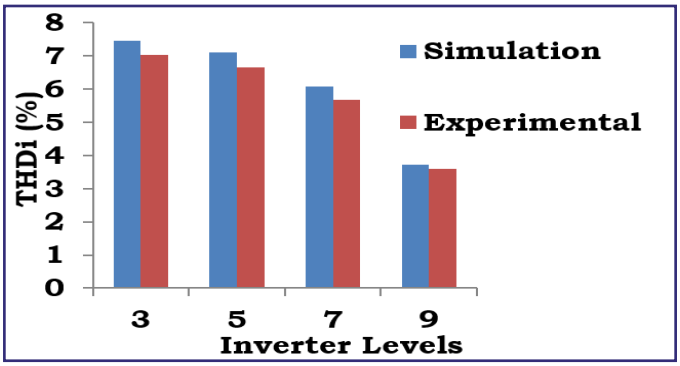


Table 1: Simulation and experimental values of Current THD

Sl No	MLI	Simulation THDi (%)	Experimental THDi (%)
1	3 level	7.46	7.03
2	5 level	7.09	6.64
3	7 level	6.06	5.67
4	9 level	3.71	3.58

Fig. 3: Simulation and experimental THDi Vs Inverter levels



3. CONCLUSION

The simulation and experimental results of current THDs of 3, 5, 7 and 9 level inverter systems are presented. Increase in number of levels of MLIs reduces the harmonic component and improves the performance of inverter system. The experimental values of THDs are slightly higher than the simulation values.

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