"Review on Hardware Andsoftware Implementation of Flying Capacitor Clamp Three Level Inverter Drive for Induction Motor"

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***Abstract*—This paper presents Performance of VFD (Variable Frequency Drive) using FCCMLI (Flying Clamped Capacitor Multilevel Inverter). A conventional voltage source inverter-fed induction motor drive is modeled and simulated using matlab Simulink and the results are presented. VFD using multilevel inverter is also simulated and the corresponding results are presented. The results obtained are compared. Using FCCMLI in VFD, Harmonics are reduced. Switching loss and EMI are also reduced.**

Keywords*-- *VFD, Problems of VFD, Multilevel Inverter, Modulation Technique, Simulation Circuits & Their results of VFD with Conventional Inverter & 3 level Inverter respectively, Analysis of THD.

I. INTRODUCTION

Induction Motor's speed is directly proportional to the supply frequency. So by changing the frequency, the synchronous speed and the motor speed can be controlled below and above the normal full load speed. The voltage induced in the stator, E is proportional to the product of slip frequency and air gap flux. The motor terminal voltage can be considered proportional to the product of the frequency and flux, if the stator voltage is neglected. The variable frequency control below the rated frequency is generally carried out by reducing the machine phase voltage, V, along with the frequency in such a manner that the flux is maintained constant. Above the rated frequency, the motor is operated at a constant voltage because of the limitation imposed by stator insulation or by supply voltage limitations. Motor damage and failure has been reported by industry as a result of adjustable speed drive inverters' high frequency PWM switching. Another drawback of conventional adjustable speed drives is efficiency. Because the inverter must switch at supersonic frequency, the associated switching losses (turn on and turn-off losses) are normally much higher than the device conduction loss, which results in low efficiency power Conversion from dc to ac. The problems associated with conventional adjustable speed drive inverters are as follows: Due to High switching frequency, switching losses increases, efficiency decreases. Rate of change of voltage is high due to switching causes motor bearing failure and stator winding insulation Breakdown.

II. LITERATURE REVIEW

JigarN. Mistry, Pratik H. Savsaniet.al [1]This paper presents Performance of VFD (Variable Frequency Drive) using FCCMLI (Flying Clamped Capacitor Multilevel Inverter). A conventional voltage source inverter-fed induction motor drive is modeled and simulated using matlabsimulink and the results are presented. VFD using multilevel inverter is also simulated and the corresponding results are presented. The results obtained are compared. Using FCCMLI in VFD, Harmonics are reduced. Switching loss and EMI are also reduced.

G. P. Adam, Olimpo Anaya-Lara, Graeme Burt, J. R. McDonaldet. al [5]Akash A. Chandekar, R. K. Dhatrak, Dr.Z. J. Khan.et.al [2]. In this paper, we have proposed a passive filter with an objective of eliminating the common-mode and differential mode voltage generated. For determining the parameters of filter, the filter transfer function is utilized to achieve a desirable filtering performance. Simulation is carried out on a 415V/3Hp induction motor sysem to verify the validity and effectiveness of proposed filter. Multilevel inverter can synthesize switched waveforms with lower levels of harmonic distortion than an equivalently rated two-level converter. The multilevel concept is used to decrease the harmonic distortion in the output waveform without decreasing the inverter power output. The most important topologies like diode-clamped inverter (neutral- point clamped), capacitor-clamped (flying capacitor), and cascaded multilevel with separate dc sources. various modulation technique in multilevel inverter are sinusoidal pulse width modulation, selective harmonic elimination. & space vector modulation.

K. Ramani1, A. Krishnan et.al [3]The paper presents a high performance flying capacitor fed induction motor drive. To improve the performance of Flying Capacitor Multilevel Inverter (FCMLI) implement the switching pattern selection scheme. This scheme reduces capacitor voltage fluctuation without using voltage feedback. This method is developed for sinusoidal voltage generation using the sinusoidal pulse width modulation technique and was compared favorably with the result when voltage feedback was used.

Yasmeena, Dr.G.Tulasi Ram Daset.al[4]This paper is a simulation study of modulation strategies in three-phase flying capacitor inverters in MATLAB simulink. The flying capacitor multilevel converter is a recently developed converter topology assuring a flexible control and modular design. However, the flying capacitor multilevel converter requires a balanced DC voltage distribution. This can be realized by using a special control leading to natural balancing or by measuring the voltages and selecting the appropriate switching state.. Under investigation those strategies that solve the capacitor voltage balancing problem, Carrier based phase-shift PWM method with APOD,IPD,POD are presented and corresponding voltage harmonic distortion values are analyzed 3level five level Flying capacitor multilevel inverters. A general mathematical model for an N-level inverter is used for circuit operation analysis and A review power system applications of flying capacitor multi-level inverters are presented.paper describes the operational principle of flying capacitor and modular multilevel inverters. The detailed discussions of dc link capacitors voltage balancing methods for both inverters are given in order to enable fair comparison. The causes of dc link capacitors voltage imbalance in flying capacitor multilevel inverter with more than three levels are highlighted. Computer simulation is used to compare the performance of both inverters under several operating conditions. the paper describes the operational principle of flying capacitor and modular multilevel inverters. The detailed discussions of dc link capacitors voltage balancing methods for both inverters are given in order to enable fair comparison. The causes of dc link capacitors voltage imbalance in flying capacitor multilevel inverter with more than three levels are highlighted. Computer simulation is used to compare the performance of both inverters under several operating conditions.

K. Ramani1, A. Rathinam, Dr. A. Krishnanet.al [6]This paper is focused on the development of capacitor voltage balancing method in a flying capacitor multilevel inverter (FCMLI) fed induction motor drive. For improving the performance of flying capacitor multilevel inverter, a switching pattern selection scheme is implemented. The proposed method has been designed a nine level flying capacitor multilevel inverter by using sinusoidal pulse width modulation technique. The selected pattern has been exposed to give superior performance in load voltage, total harmonics distortion and capacitor voltage fluctuation. The performance of proposed strategies is confirmed through simulation investigations.

III. PROPOSED METHODOLOGY

The FCMLI requires a large number of capacitors to clamp the device (switch) voltage to one capacitor voltage level. Provided all the capacitors are of equal value, an n-level inverter will require a total of (n-1)×(n- 2)/2 clamping capacitors per phase leg in addition to (n-1) main dc bus capacitors. The size of the voltage increment between two consecutive legs of the clamping capacitors defines the size of voltage steps in the output waveform.

The various switching strategies that have been proposed for synthesizing output voltage with minimum distortion, sinusoidal pulse width modulation (SPWM) strategy is employed here.

In this method, a number of triangular waveforms are compared with a controlled sinusoidal modulating signal and the switching rules for the switches are decided by the intersection of the carrier waves with the modulating signal. For a 5-level inverter, a modulating signal and 4 carrier waves are required for each phase of the inverter.

The modulating signal of each phase is displaced from each other by 120°. All of the carriers have the same frequency fc and the same amplitude Ac, while the modulating signal has a frequency of fm and amplitude of Am. Fc should be in the multiples of three-times to that of fm. This is required such that all the modulating signal of all the three phases see the same carriers, as they are 120° apart.

IV. PROPOSED BLOCK DIAGRAM

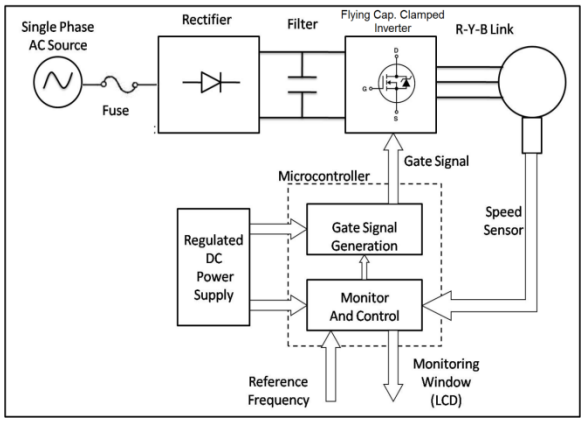

Fig. 1 Proposed Block Diagram

V. CONCLUSION

Multilevel inverter fed induction motor drive is simulated using the blocks of Simulink. The results of multilevel inverter system are compared with the results of VSI based drive system. It is observed that the total harmonic distortion produced by the multilevel inverter system is less than that of VSI fed drive system. Therefore the heating due to multilevel inverter system is less than that VSI fed drive system. The simulation results of voltage, current, speed and torque are presented. This drive system can be used in industries where adjustable speed drives are required to produce output with reduced harmonic content.

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