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A SYMMETRICAL CASCADED H-BRIDGE MLI FOR INDUCTION MOTOR DRIVE

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Abstract:

Most of the industrial drives use ac induction motor because these motors are rugged, reliable, and relatively inexpensive. Induction motors are mainly used for constant speed applications because of unavailability of the variable frequency supply voltage But many applications need variable speed operations. Historically, mechanical gear systems were used to obtain variable speed. Recently, power electronics and control systems have matured to allow these components to be used for motor control in place of mechanical gears. Present day drive types are the Induction motor drives with voltage source inverters. Also the voltage waveforms of traditional two level inverter fed Induction motor shows that the voltage across the motor contains not only the required "fundamental" sinusoidal components, but also pulses of voltage i.e. "ripple "voltage. The recent advancement in power electronics has initiated to improve the level of inverter instead increasing the size of filter. The total harmonic distortion of the classical inverter is very high. The performance of the multilevel inverter is better than classical inverter.

Keywords – Rugged, Control, Harmonics, distortion.

1. INTRODUCTION

In other words the total harmonic distortion for multilevel inverter is low. The total harmonic distortion is analyzed between multilevel inverter and other classical inverter. To get the speed control of induction motor, we need vary both voltage and current.

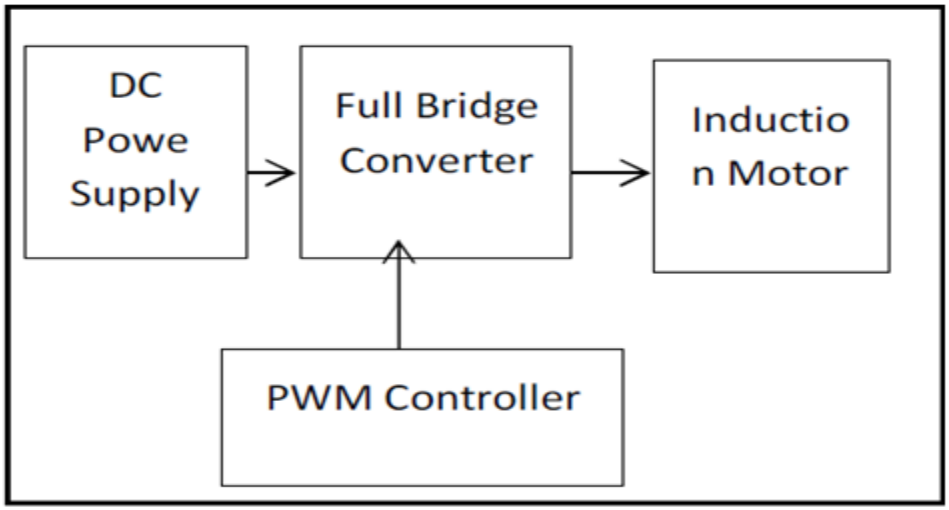

Fig.1.Basic Block diagram

This technique is called as constant V/F method. By choosing the suitable inverter we can vary both voltage and frequency of the induction motor to get the required speed control. Normally the conventional H-bridge inverter produces a square output, which contains infinite number of odd harmonics and dv/dt stress is also high. Normal PWM inverter can reduces the THD, but Switching losses are high and also this inverter is restricted to low power applications. The importance of multilevel inverters [MLI] has been increased since last few decades. These new types of inverters are suitable for high voltage and high power application due to their ability to synthesize waveforms with better harmonic spectrum and with less THD.

2. PROPOSED SYSTEM

The complete system will consist of two sections; a power circuit and a control circuit. The power section consists of a power rectifier, filter capacitor, and three phase diode clamped multilevel inverter. The motor is connected to the multilevel inverter. An ac input voltage is fed to a three phase diode bridge rectifier, in order to produce dc output voltage across a capacitor filter. A capacitor filter, removes the ripple contents present in the dc output voltage. The pure dc voltage is applied to the three phase multilevel inverter through capacitor filter. The multilevel inverter has IGBT switches that are controlled in order to generate an ac output voltage from the dc input voltage. The control circuit of the proposed system consists of three blocks namely microcontroller, opto coupler and gate driver circuit. The microcontroller is used for generating gating signals required to drive the power IGBT switches present in the multilevel inverter. The voltage magnitude of the gate pulses generated by the microcontroller is normally 5V. To drive the power switches satisfactorily the opto- coupler and driver circuit are necessary in between the controller and multilevel inverter. The output ac voltage is obtained from the multilevel inverter can be controlled in both magnitude and frequency.

3. INDUCTION MOTOR

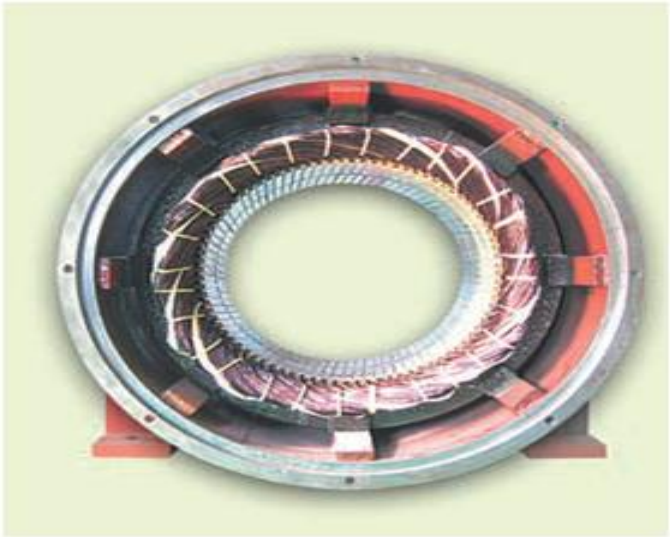

Fig.2. Stator

Three-phase asynchronous motors can be considered among the most reliable electrical machines: they carry out their function for many years with reduced maintenance and adapt themselves to different performances according to the requirements of both production as well as service applications. As already said, these motors find their application in the most different industrial sectors, such as food, chemical, metallurgical industries, paper factories or water treatment and extractive systems. The applications concern the equipment with machine components running at fixed or variable speed such as for example lifting systems as lifts or good hoists, transporting systems as conveyors, ventilation and air conditioning installations, without forgetting the commonest use with pumps and compressorsFrom the above considerations it is easily deduced how three-phase asynchronous motors can be considered the most widespread electric machine for industrial applications (the power consumption of electrical motors is about 75% of the total consumption in the industrial field). Considering this datum it is possible to understand how a reduction in power consumptions can be important for both the business management (the cost of a motor in its whole life is due to power consumption for about 98% and to purchase and maintenance costs for the remaining 2%) as well as for the improvement of the power efficiency.

4. MULTILEVEL INVERTERS

The power in the battery is in DC mode and the motor that drives the wheels usually uses AC power, therefore there should be a conversion from DC to AC by a power converter. Inverters can do this conversion. The simplest topology that can be used for this conversion is the two-level inverter that consists of four switches. Each switch needs an anti-parallel diode, so there should be also four anti parallel diodes. There are also other topologies for inverters. A multilevel inverter is a power electronic system that synthesizes a sinusoidal voltage output from several DC sources. These DC sources can be fuel cells, solar cells, ultra capacitors, etc. The main idea of multilevel inverters is to have a better sinusoidal voltage and current in the output by using switches in series. Since many switches are put in series the switching angles are important in the multilevel inverters because all of the switches should be switched in such a way that the output voltage and current have low harmonic distortion. Multilevel inverters have three types. Diode clamped multilevel inverters, flying capacitor multilevel inverters and cascaded H-bridge multilevel inverter. The THD will be decreased by increasing the number of levels. It is obvious that an output voltage with low THD is desirable, but increasing the number of levels needs more hardware, also the control will be more complicated. It is a tradeoff between price, weight, complexity and a very good output voltage with lower THD.

5. SIMULATION RESULTS

Sim Power Systems and other products of the Physical Modeling product family work together with Simulink ® to model electrical, mechanical, and control systems. Sim Power Systems operates in the Simulink environment.Therefore, before starting this user's guide, you should be familiar with Simulink. For help with Simulink, see the Simulink documentation. Or, if you apply Simulink to signal processing and communications tasks (as opposed to control system design tasks), see the Signal Processing Block set documentation.MATLAB features a family of add-on application-specific solutions called toolboxes. Very important to most users of MATLAB, toolboxes allow you to learn and apply specialized technology. Toolboxes are comprehensive collections of MATLAB functions (M-files) that extended the MATLAB environment to solve particular classes of problems. Areas in which toolboxes are available

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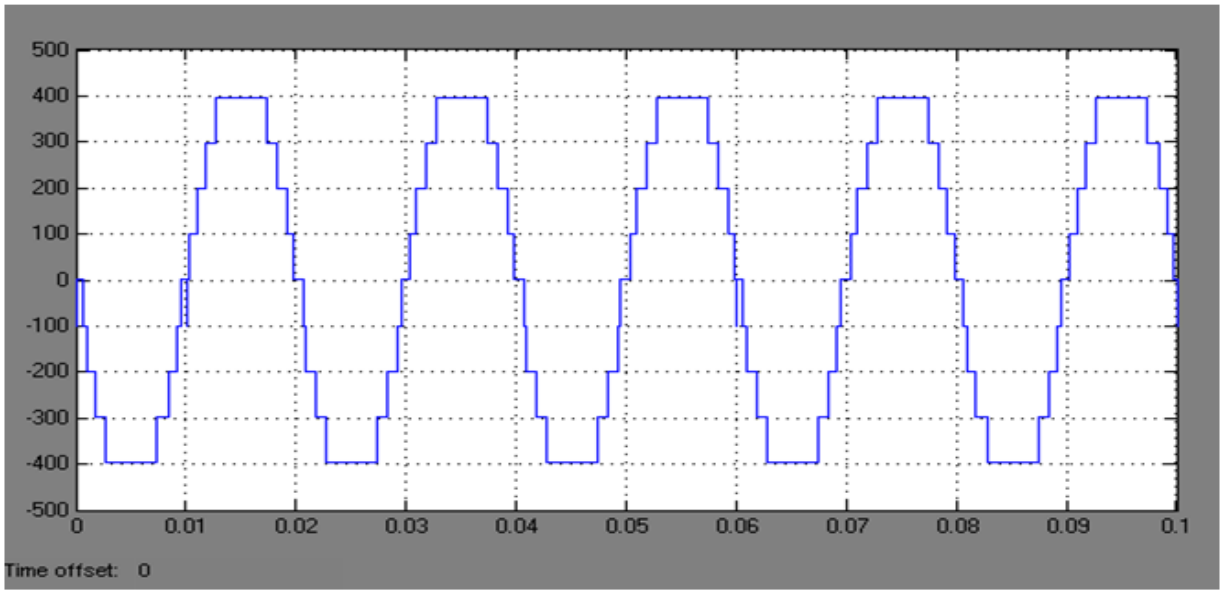

Fig.3. Voltage waveform

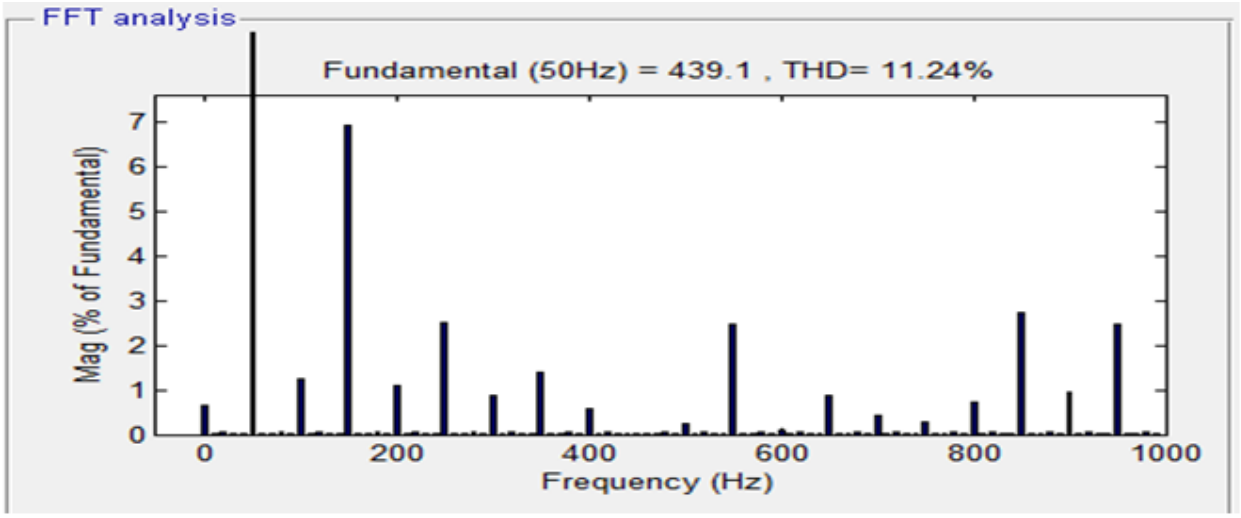

Fig.4.Current THD

include signal processing, control systems, neutral networks, fuzzy logic, wavelets, simulation, and many others.

CONCLUSION

In this project a Cascaded H-Bridge multilevel inverter has been presented for induction motor drive applications. The multicarrier PWM technique can be implemented for producing low harmonic contents in the output, hence the high quality output voltage was obtained. A Nine level cascaded multilevel inverter is designed for induction motor drive. It is observed that the MLI with nine level has lesser THD in voltage and current. Thus the designed MLI is found to be a promising alternative for induction motor drives.

REFERENCES

[1] NasrudinAbd. Rahim, MohamadFathiMohamad Elias, Wooi Ping Hew, IEEE transaction. Industry Electronics, "Design of filter to reduce harmonic distortion in industrial power system", Vol. 60, No: 8, 2943-2956, August 2013.

[2] J. Selvaraj and N. A. Rahim, "Multilevel Inverter For Grid-Connected PV System Employing Digital PI Controller," IEEE Trans. Ind.Electron., vol. 56, pp. 149-158, 2009.

[3] Naderi and A. Rahmati, "Phase-Shifted Carrier PWM Technique for General Cascaded Inverters," IEEE Trans. Power Electron. vol. 23, pp. 1257-1269, 2008.

[4] J. Rodriguez, J.-S. Lai, and F. Z. Peng, ―Multilevel inverters: A survey of topologies, controls, and applications,‖ IEEE Trans. Ind. Electron., vol. 49, no. 4, pp. 724–738, Aug. 2002.

[5] M. Malinowski, K. Gopakumar, J. Rodriguez, and M. A. Pérez, ―A Survey on cascaded multilevel inverters,‖ IEEE Trans. Ind. Electron., vol. 57, no. 7, pp. 2197-2206, July 2010.

[6] S. J. Park, F. S. Kang, M. H. Lee, and C. U. Kim, ―A new single-phase five-level PWM inverter employing a deadbeat control scheme,‖ IEEE Trans. Power Electron., vol. 18, no. 18, pp. 831–843, May 2003.

[7] N. A. Rahim, and J. Selvaraj, ―Multistring five-level inverter with novel PWM control scheme for PV application,‖ IEEE Trans. Ind. Electron., vol. 57, no. 6, pp. 2111-2123, June 2010.