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Multi-Level Inverter Fed Induction Motor Drive

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Abstract **–The multi-level pwm is asophistorical technique for controlling AC motors by generating a fun- mental sine-wave that provides pure voltage to the motor with lower THD(total harmonic distortion).This method overcomes the old technique The proposed system uses a micro-controller of the 8051 family and a rectified power supply .In this system, a MOSFET (inverter)is used for developing a single –phase power to run the motor ,which is interfaced to the microcontroller with the help of the opto- isolator and switch driver. The Opto-isolator is used to isolate load circuit and control circuit. A MOSFET driver is used to drive the MOSFET. DC supply is proposed from the single-phase AC after rectification. The rectified DC supply is fed to the voltage regulator. The microcontroller, which produces the PWM pulses. By these pulses width modulations, we can control the speed of the induction motor and we get pure sinusoidal waveform. Speed control of the motor can be achieved by V/F method.**

Key Words: Microcontroller, Switching frequency. Opto-isolator, MOSFET, Switch driver, Induction motor.

1. INTRODUCTION

Induction motor is the most widely used electrical machine in almost all simple, medium and high voltage industrial applications, because of its low cost and increased reliability. Hence, ac drives like induction motor drives along with power electronic converters have replaced the dc motor drives in industries. The difficulty in using ac drives lies with the selection suitable power electronic converter. The non linear dynamic performance of the induction motor, which constitutes additional non- linearity in the converter dynamics and the switching performance, adds to the difficulty level of the control task. And also, when pulse width modulation (PWM) is used for the control of the power electronic converter, duty ratio input needs to be bounded in a specific range as this can create stability issues. Thus, the power conversion stage is playing a vital role. A multilevel inverter could be a great choice for replacing the conventional voltage source inverters or current source inverters. Multilevel inverters have many advantages like reduced voltage Stress, increased quality of output voltage and increased power rating. Multilevel power converters can be defined as voltage synthesizers, in which many small discrete voltage levels add to synthesize a high output voltage.

2. BLOCK DIAGRAM

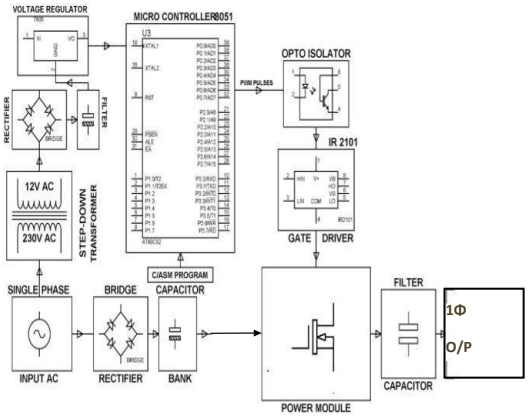

Fig:2 Block diagram

3. SPECIFICATION OF THE COMPONENTS

Serial	Name of the Component	Specification	Number Required
1	Regulated power supply		1
2	Transformer(step-down)	Single phase (230v to 12v)	1
3	Opto- coupler	4N35 Opto-coupler	1
4	Microcontroller	AT89S52	1
5	Gate driver	IR2101	1
6	MOSFET		1
7	Voltage regulator	IC7805(+5v	1
8	LCD	16 pins	1
9	Capacitor Filter		3
10	Resistance	1KΩ	1
11	Bridge rectifier		2

Table:1 Table containing list of components with their specifications.

4. WORKING

When this single-phase motor drive is directly connected to power supply/230V ac then these ac voltages are converted into dc through bridge rectifier but these are not pure dc voltage these are basically the pulsating dc voltage. The capacitor bank is connected at the output of rectifier, which removes the ac contents & provide pure dc voltages to the voltage source. The voltage source inverter, which is basically, consists of semiconductor switches. When these switches are operated through the pulse width modulation technique, which is provide by the microcontroller, then these switches invert the dc voltage

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in to single phase ac voltage. These single phase ac voltages are used for operating the single phase ac motor. We can change speed of motor by changing the frequency of pulse width modulation through microcontroller.

5. ADVANTAGES

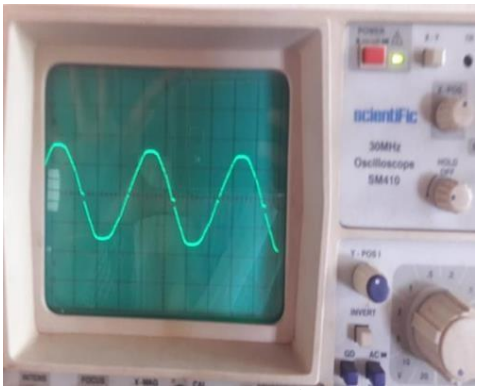
1. Low voltage current ripple.
2. Maximum utilization of dc link voltage.
3. Reduction of acoustic noise of induction motor drives.
4. Simple & easy hardware implementation by an embedded program.
5. Reduced switching losses.
6. Less harmonic distortion in the O/P voltage.

6. DISADVANTAGES

1. Limited to certain applications where separate DC sources are available.
2. More complex control circuit.

7. RESULT

From the simulation results of the proposed work "Multilevel Inverter Fed Induction Motor Drive" it is shown that it generates less harmonics and high output voltage for the given modulation. Compared to SPWM, the Lower Order Harmonics (LOH) and Total Harmonic Distortion (THD) contents are decreased. Therefore multi-level inverter is preferred over the SPWM for the speed control of induction motor. The proposed system also contributes to the increased efficiency of the drive system.



WAVEFORM -1: Name of the chart

EXPERIMENTAL VALUE:

SI.NO	LEVELS	FINAL VOLTAGE (V)
01	1	97
02	2	120
03	3	140
04	4	155
05	5	176
06	6	200
07	7	218
08	8	228
09	9	231

8. CONCLUSIONS AND FUTURE WORK

Inverter fed Induction Drive system is modeled, simulated & implemented successfully. The simulation and experimental result for stator(voltage & current), rotor speed and FFT spectrum can be presented. Multi-level inverter system is better than VSI fed drive system due to the reduced value of THD. Thus this scheme is better than sine-triangle PWM scheme. Space vector pulse width modulation is new and best technique which is ruling the world now.

This project can be extended using IGBT in place of MOSFET. We can extend the levels and we can make input as single phase and take output three phase.

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