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Sinusoidal Pulse Width Modulation Based Speed Control of Induction Motor using Fifteen Level Diode Clamped Multilevel Inverter

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Abstact: The main purpose of this work is to use a fifteen-stage diode clamped multi-level inverter that is able to control the speed of an induction motor. To get reduced synchronization and high quality sine curve output voltage. The proposed plan for the diode clamped multilevel inverter is controlled using multicarrier SPWM control. An open circle speed control can be accomplished by utilizing the V/f strategy. This strategy can be executed by changing the recurrence utilized in the three-stage induction motor at the stock voltage and the consistent rate. The proposed system, which results in a poor driver performance, is a useful alternative to the conventional method with high transient losses. Simulation depicts an improved drive performance by reducing the Total Harmonic Distortion resulting from the simulation and effectively controlling the motor speed.

Keyword: This strategy can be executed by changing the recurrence utilized in the three-stage induction motor at the stock voltage and the consistent rate.

I. INTRODUCTION

The main area of work is the industrial motor, where a trigger motor is positioned in the outer part of the station, with the air spaced carefully between the two inside and one rotor. Almost all electrical engines use magnetic rotation to spin their rotors. A single phase induction motor is the type of rotating magnetic because the source of the input source is usually created. DC motors rely on getting into mechanical or electronic steering to create rotating magnetic fields.

There is no direct approach to restoring controlled outputs from ordered entries. So it needs to generate output control data accordingly. This is obtained by a two phase transition tripartite where the current and torque output equal currents are obtained. The machine is valid only in the equilibrium position state. In adjustable speed drives, the device usually An element is formed in a feedback, so its transient behavior is being taken into account. Besides, for such astronauts, the high efficiency of control is based on the dynamic d-k model of the engine. Therefore, we go to the d-Q model for the principle of space biology. Derivative equations can describe the time-machine model, and require mutual inductance: but such a model tends to be more complicated.

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Compare a high frequency triangular waveform with a transition waveform to generate SVM pulses. Mathematical modeling can be implemented using the following steps. Constantly changing the sampling time of five symmetric pulse times in two intervals. Note to describe the width of the symmetric pulse that is conveniently distributed between and across organisms In This work there is an induction motor where the force is the characteristic motor of an object supplied to the rotating device using electromagnetic induction. Another commonly unused name is the squirrel cage motor because the rotor bars resemble a squirrel cage (hamster wheel) with short circuits. Public utility A device that converts electrical power to mechanical power on its rotor.

There are many ways to evaluate the rotor's performance. The rotor of the motor is approximately the sine curve rotating machine distributed through the N during the static engine. Unlike the previous model, the voltage is distributed around the existing voltage motor.

II. LITERATURE SURVEY

Still, the country faces a huge gap between its energy generation and its needs. About two-thirds of villages are electrified due to geographical and economic factors. Solar PV technology due to the installation costs and losses, eliminating workplace can create the potential for a large through innovation [2] attractive methods of these power quality problems in order to solve an alternative drive system in this paper exercise proposed standard volt / matrix converters with induction motors.

Matrix Converters are a relatively new to develop AC voltage controllers that provide output voltage to control the undesirable power at the input as well as the uncontrolled event while maintaining output [3]. Therefore a heavy DC connection capacitor may otherwise avoid the need for a conventional drive system [4] except that the AC serves as a stand-alone induction motor drive concession for converting the AC to an advanced power-quality drive. This paper has proposed an alternative matrix converter (MC) based driving method so that power quality issues that are associated with conventional VSDs [5] can be solved.

Notwithstanding improving the source side force quality, single stage AC additionally uncovers the upsides of AC transformation, for example, grid converter-driven induction motor drives, dispensing with the requirement for about vitality sparing components, directional and decrease [6].

The dynamic reaction of MC-based driver frameworks has arrived at the equal stage that most traditional PWM VSI-based drivers offer, because of the innate impediments of most balance algorithrns utilized by grid converters, in spite of the fact that the speed control extend is regularly altered by MC-based drives [7].

The PLLC IM [8] estimates the frequency and amplitude of the voltage/current waveform, individually. The other two voltages are evaluated by giving the right defer utilizing flows/a traffic delay. Furthermore, the IM speed is evaluated from the PLLC frequency order. PIDTC gives a critical mutilation of current, stream, and torque because of lackluster showing of PI-controllers [9]. The induction motors strategy utilizing the novel type of direct torque and transition control (DTFC)- Model Prediction Control (MPC) [11]. This MPC strategy depends on novel, standard DTFC strategies from the force (three stage inverter) point of view instead of utilizing a solitary voltage vector with control quantifies over a total testing time of the controller.

III. PROPOSED SYSTEM

Multilevel inverters are an alternative to moderate voltage applications. Inverters are symmetric and asymmetric topologies within the kind of time. Asymmetric inverters have different DC voltage values. 3n = 15 positions of different cells (reversed by N = 5) is the most common localization when the cascade arrangement is implemented in DC voltage multiplier without obtaining an AC voltagehis topology yields a low harmonic, at < 3%. However, this is a neglected disadvantage in the presence of some regeneration independently of the load type of inverters, which is high quality voltage. This phenomenon modulation technique (near-level modulation) is the reason this inverter is used. In this work, an asymmetric 15 level inverter is provided. Some of the capacity batteries - from inverter reloading to power flow - are designed to avoid this inverter regeneration problem. This is obtained by obtaining the imaging angles corresponding to the power cells considering a minimum load voltage THD. Finally, a power flow analysis is accomplished and the simulated results show the possibility of this approach.

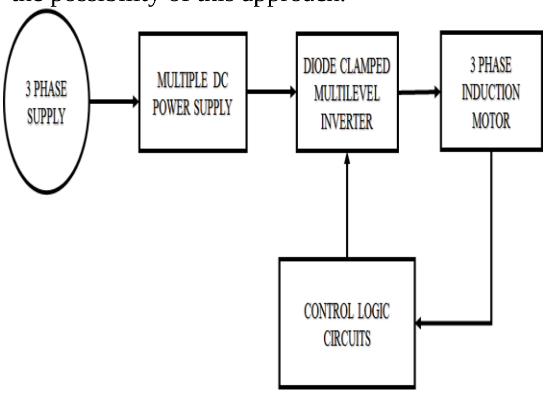

Figure 1 Proposed system block diagram

The step-by-step inverter module is a three-stage induction motor shown in Fig.1. The whole system consists of two sections; a power circuit and a control circuit. The power section features a power rectifier, filter capacitor, and three-phase diode hierarchical inverter. The motor phase inverter is connected.

The three stage diode connect amends the DC yield voltage over the capacitor channel. A capacitor channel expels the wave substance to display the DC yield voltage. Three-stage inverter with unadulterated DC voltage capacitor channel is utilized.The hierarchical inverter has 24 masked switches controlled from the DC input voltage to generate an output AC voltage. The gate drive circuit consists mainly of the control system of the proposed system. Here the Multicarrier PWM technique is used to produce gate pulses for IGBT switches. The output AC voltage step is obtained by controlling both the inverter level and the frequency (V / f open loop control). Controlled output AC voltage induction motor drive. When the power is on the switches, the current reaches the motor DC bus flows. Motor circuits are very comparative in nature; They hold electrical energy in their current form. Since the switches are off, these current requirements must be degraded.

When switching off the switches are associated with diodes throughout to give a path to the current to exit. These dipoles are additionally called uniaxial diodes. The V/f control framework permits the client to control the speed of an induction motor at various rates. For constantly shifting velocity activity, the yield frequency of the various leveled inverter must differ. The voltage to the motor should likewise differ with the direct proportion of the frequency of supply to keep up the motor stream.

Equivalent Circuit

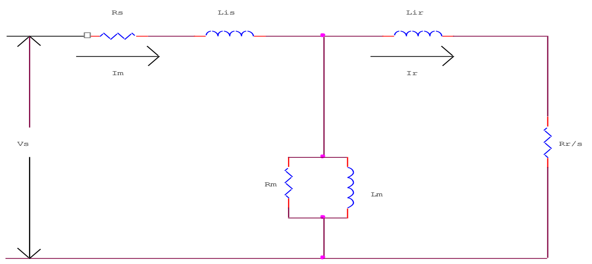

Figure 2 : phase equivalent circuit of induction motor

The various power expressions from the equivalent circuit diagram can be written as follows:

Input power =$3V_sI_sCOS\emptyset$. … (1)

Core loss=$\frac{3Vm^2}{R_m}$.

Rotor copper loss $P_k = 3I^2{}_r$.

Output power Po =$P_g - Pl_r$.

$\frac{R_r}{S}I^2{}_r$ … (2)

Since the output power is the product of developed torque T_e and speed ω_m, T_e can be expressed as

$$T_s = \frac{P_0}{w_m} \quad \text{…. (3)}$$

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$$T_e = \frac{3}{w_m} I^2{}_r R_r \left(\frac{1-s}{s}\right) = 3\left(\frac{P}{2}\right) I^2{}_r \frac{R_r}{s w_e} \ldots (4)$$

From the equivalent circuit, as shown in FIG. 4, where the core loss resistor Rm has been deleted and the magnetizing inductance Lm has been transferred to the input, an approximate equivalent circuit can be obtained. This approximation is reasonable easy for a full horsepower machine,

where

$$(R_s + j\, w_e L_{is}) \ll w_e L_m \ \ldots (5)$$

The performance prediction by the simplified circuit typically varies within 5 percent

Vector control method

An extremely straightforward and practical strategy for speed control is to change the stator voltage at a consistent force frequency. The three-stage stator voltage at line frequency can be controlled by controlling the switches in the inverter. It tends to be seen from this equation that the created torque is corresponding to the square of the speed.

IV. RESULT AND DISCUSSION

MATLAB (Matrix Lab) is a multi-paradigm numerical computing environment. A proprietary programming language developed by Math Works, MATLAB allows matrix operations, functions and data, implements algorithms, creates user interfaces, interfaces with other languages, including C, C ++ program plots, they create dynamic Simulink model systems and Based on power electronics model.

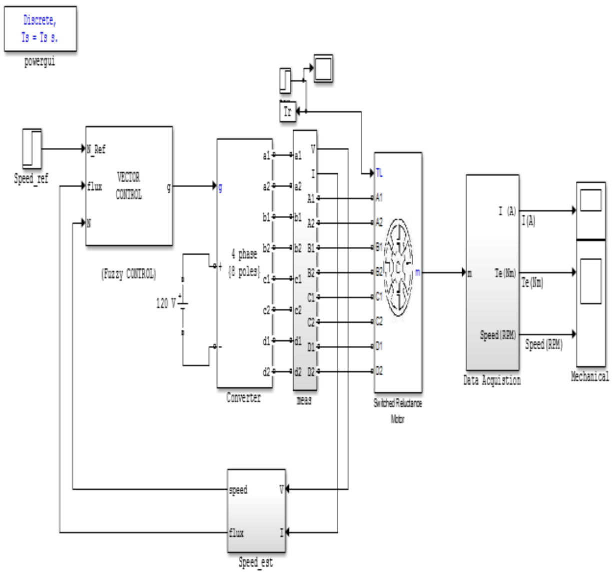

Figure 3 Matlab Simulink for development of sr motor using Neuro Fuzzy logic algorithm

The figure 3 shows the Simulink model of SR motor using fuzzy logic algorithm. The Motor torque ripples are reduced using Instantaneous direct torque control technique.

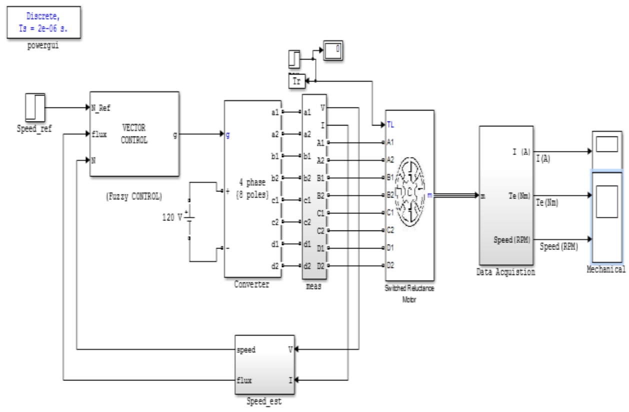

Figure 4 Matlab simulink for development of sr motor using Fuzzy logic algorithm

The figure 4 shows the simulink model of SR motor using fuzzy logic algorithm. The Motor torque ripples are reduced using Instantaneous direct torque control technique.

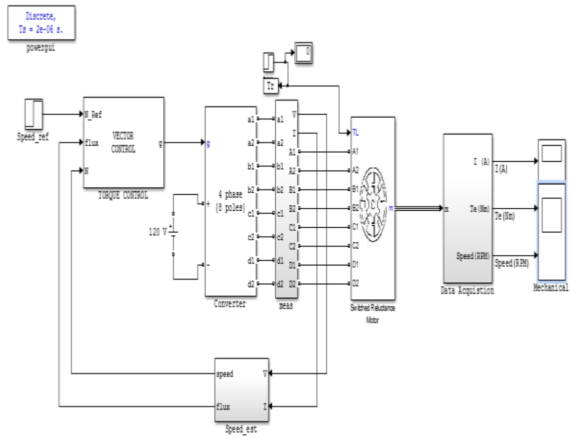

Figure 5 Matlab simulink for development of sr motor using PI controller

The figure 5 shows the Simulink model of SR motor using PI controller algorithm. The Motor torque ripples are reduced using Instantaneous direct torque control technique.

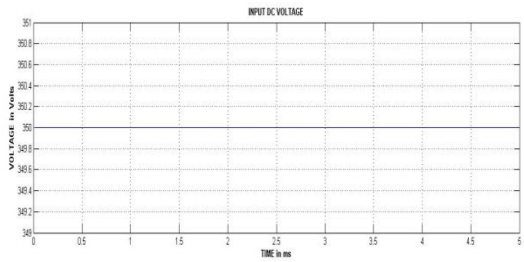

Figure 6 Input voltage waveform to the BR converter

Figure 6 shows the input voltage to the BR converter, the 350v is applied to the BR converter. It will convert the DC voltage into AC voltage. This voltage is then fed to the four phase SR motor.

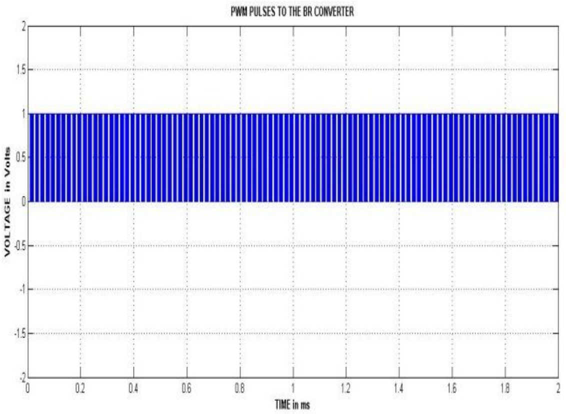

Figure 7 PWM pulses to the BR converter

The figure 7 shows the PWM pulses to the BR converter. The pulses are produced using Direct instantaneous torque control. The switching frequency of the pulses is 25Khz.

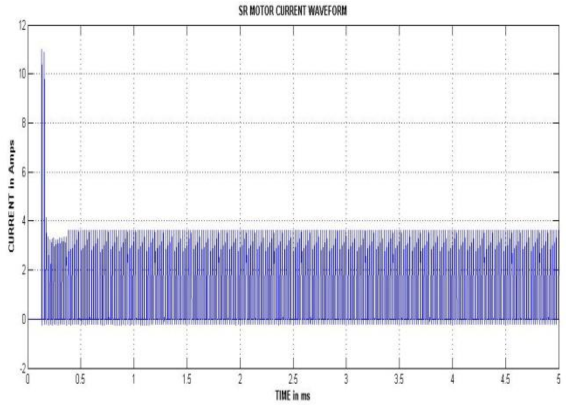

Figure 8 Motor current waveform

The figure 8 shows the current waveform of the SR motor. The motor initially taking high current due to nature of material. Also its having higher order ripple currents, this causes to produce noise in the torque waveform.

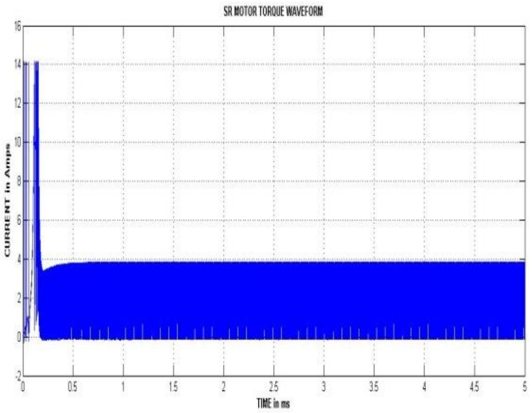

Figure 9 Motor torque waveform

The figure 9 shows the SR motor torque waveform, due to the current ripples in SR motor high torque ripples are produced.

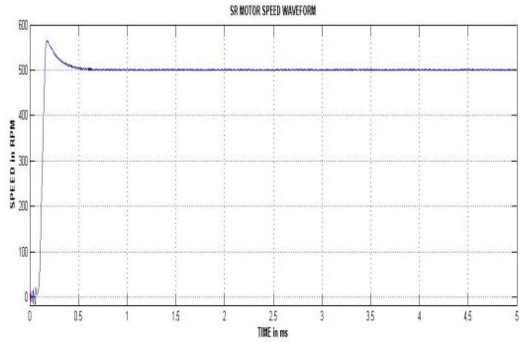

Figure 10 Motor speed waveform using PI controller

The figure 10 shows the speed waveform of the SR Motor using PI controller, but the PI controller induces noises in the speed due to maximum peak overshoot problem.

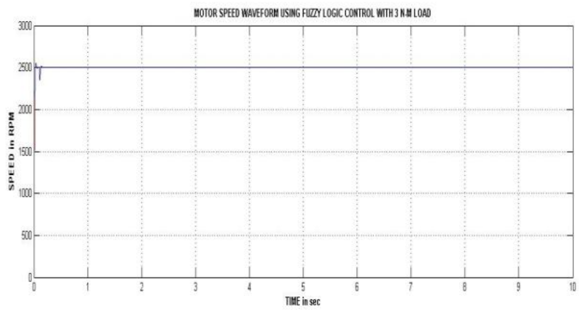

Figure 11 Motor speed waveform using Neuro fuzzy logic controller

The figure 11 shows the SR motor speed waveform using Neuro fuzzy logic controller. The neuro fuzzy logic controller reduces the speed oscillation in the motor waveform. Also settling time is very less compared to the PI controller.

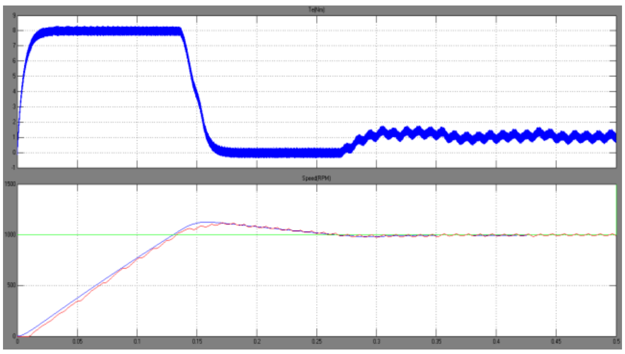

Figure 12 Motor speed and torque waveform using Neuro fuzzy logic controller

The figure 12 shows the motor torque waveform of the SR motor. The NF controller reduces the torque ripples also. Its coming only 1.7 Nm torque ripples.

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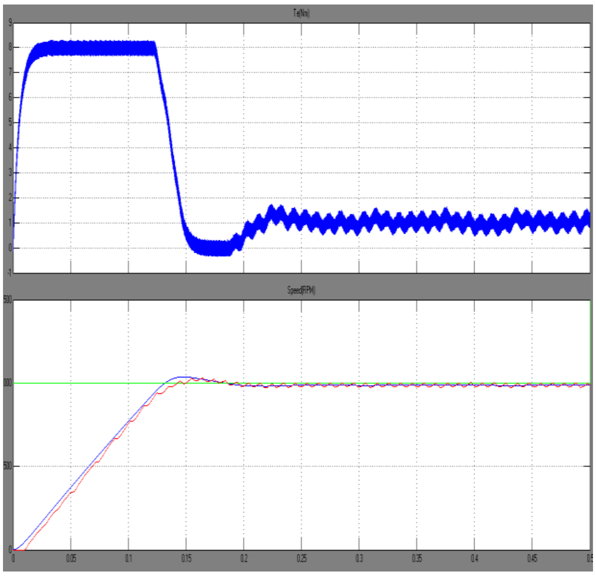

Figure 13 Motor speed and torque waveform using PI controller

The figure 13 shows the motor speed and torque waveform using PI controller, this PI controller produces oscillation in the speed waveform at both hysteresis as well as IDTC torque control technique. In PI controller its showing 1.8 Nm torque ripples.

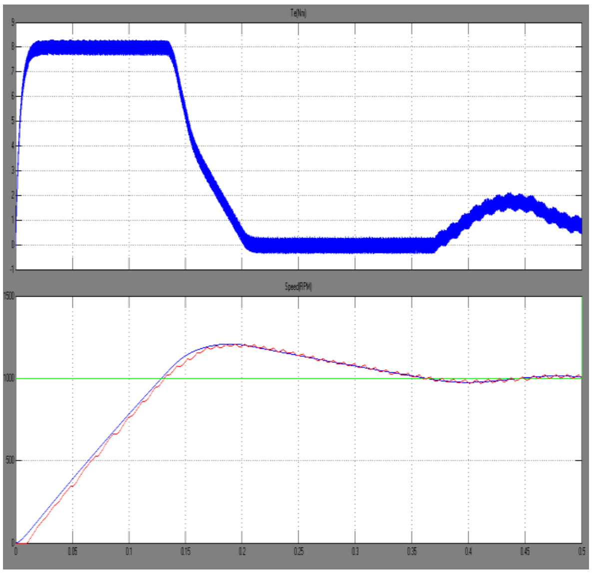

Figure 14 Motor speed and torque waveform using fuzzy logic controller

The 14 shows the motor speed and torque waveform using fuzzy logic controller, this fuzzy logic controller reduce the speed oscillation, because fuzzy is the self-tuning method. In fuzzy the torque ripples comes to 1.75 Nm.

V. CONCLUSION

In this work a diode clamped The main purpose of this work is to use a fifteen-stage diode clamped multi level inverter that is able to control the speed of an induction motor. To get reduced synchronization and high quality sine curve output voltage. The proposed scheme for the diode is hierarchical inverter multicarrier SPWM control. An open loop speed control can be achieved by using the V / *f* method. This method can be implemented by changing the frequency used in the three-phase induction motor at the supply voltage and the constant rate. The proposed system, which results in a poor driver performance, is a useful alternative to the conventional method with high transient losses. Simulation depicts an improved drive performance by reducing the Total Harmonic Distortion resulting from the simulation and effectively controlling the motor speed. The drive system can be energy-saving boiler feed pump conveyors, rolling mills, printing machines, etc. used in variable torque load applications.

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