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Engineering

A THREE PHASE THREE SWITCH INVERTER FED INDUCTION MOTOR DRIVE WITH PFC BASED CONVERTER

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ABSTRACT An induction motor is used in 70% of the industrial applications nowadays because of its simple and rugged construction and can be operated under any environmental conditions. In conventional method, 6 switch voltage source invertor is used to drive a 3 phase induction motor. This paper deals with a strategy to replace the 6 switch invertor with a 3 switch invertor. This will improve the voltage utilization factor of the DC supply when compared with the conventional invertor. So a new DC-AC convertor with reduced number of switch is used to generate pure sinusoidal line to line voltage and power factor correction is also done with a zeta convertor.

KEYWORDS : 3 phase supply, 3 switch VSI, Zeta converter, PFC controller, induction motor

INTRODUCTION

New technologies and inventions increase day by day. So it must move on integrating new technologies in such a way that more possible outcomes could be made. Due to the new researches it was possible to replace existing 6 Switch VSI with 4 switch VSI. Now this 4 switch VSI could again be replaced with 3 switch VSI. This become more advantages because of power factor improvement, improvement in voltage utilization factor reduces harmonic distortions. This project uses a bridgeless zeta converter, pfc controller, and an induction motor along with three phase three switch inverter. Zeta converter performances a non-inverting buck boost function. The range of duty ratio is much wider than any other converter. The conduction losses of DBR are reduced to half by using bridgeless topology which also offers improved thermal utilization of converter switch. Power factor correction controller family uses boost topology are suitable for AC/DC power system and over the universal line input. With the invention of high speed power semiconductor drive three phase inverter play the key role for variable speed AC motor drives. The main objective is that the application of three phase inverter could be achieved and a noval three phase inverter for electric drives, that is a low cost converter for irrigation purpose like water pumping.

PROPOSED METHODOLOGY

The proposed methodology consists of: AC supply, bridgeless Zeta converter, 3 phase 3 switch VSI and induction motor. This along with their interactions is shown as a block diagram (Fig 1).

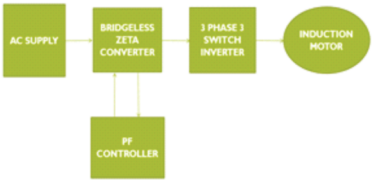


Fig 1: Block diagram showing the proposed scheme

THREE SWITCH INVERTER

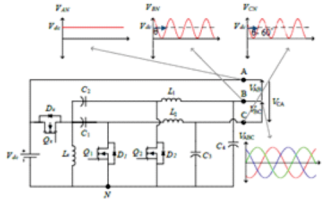


Fig 2: Circuit diagram of 3 phase 3 switch inverter

It is applicable for induction motor drives. The non-torque producing zero sequence current is significantly increased, which necessities oversized dc-link capacitors. This inverter is only used in situation where the dc-link midpoint and the motor neutral point can both be accessed.

This is the first time a three phase universal inverter with only three power switches has been proposed. The proposed converter has better voltage utilization factor of the input dc supply compared to both the four-switch three-phase inverter and standard six-switch three-phase inverter with sinusoidal pulse width modulation (SPWM) controller (Fig 2).

The proposed inverter does not suffer from the problems of circulation of one-phase current through the split dc-link capacitors. Three-phase output voltages are pure sinusoidal waves and total harmonic distortion is minimized.

BRIDGELESS ZETA CONVERTER

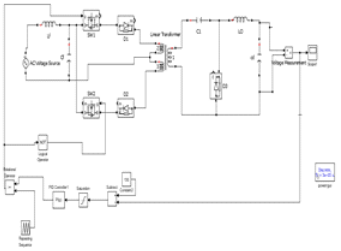


Fig 3: Circuit diagram of Bridgeless Zeta Converter

An isolated zeta topology without bridging is designed so that both switches behave independently for the positive and negative half cycles of the supply voltage. The conduction losses of the DBR are halved compared to the conventional topology due to the bridgeless configuration. In addition, it also improves the thermal utilization of the switches since the total effective current of the switches is divided into two switches. In addition, the Zeta converter provides isolation between DC input and output, continuous output current, reduced electromagnetic interference. Thus, the operation of the converter can be explained in the positive and negative half-cycles of the supply voltage.

PFC CONTROLLER

PFC (power factor correction, also known as power factor controller) is a feature included in some computers and other power supplies that reduces the amount of reactive power generated by a computer. The

reactive power operates perpendicular to the true power and activates the magnetic field.

INDUCTION MOTOR

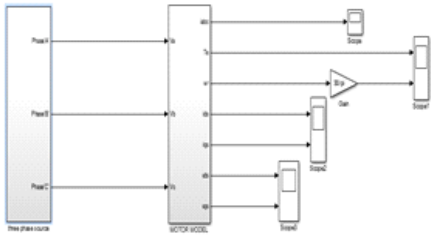


Fig 4: Schematics of Induction Motor

DC motors have been used in the last century in industries for variable speed applications because their flux and torque can be easily controlled by modifying field and armature currents, respectively. Induction motors were mainly used for essentially constant speed applications due to the unavailability of the variable frequency power supply. The advancement of power electronics has allowed the frequency of the voltage supplies to vary relatively easily, which has prolonged the use of the induction motor in variable speed drive applications. But because of the inherent coupling of the flux and torque components in the induction motor, it has not been possible to provide a torque as efficient as the DC motor. Fig 5 shows the schematics of an induction motor.

RESULTS

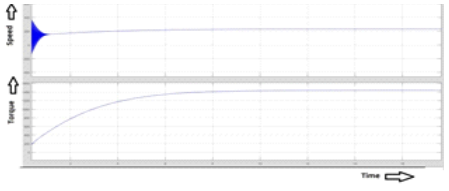


Fig 5: Waveform of speed and torque

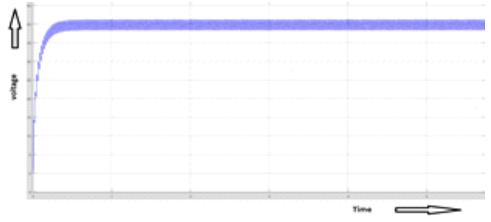


Fig 6: waveform of Zeta output voltage

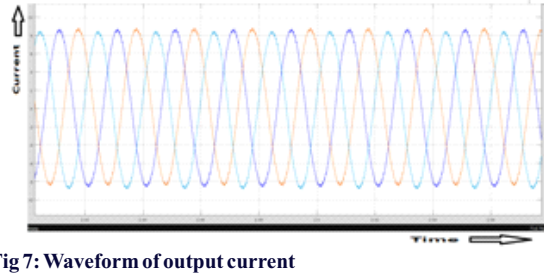


Fig 7: Waveform of output current

CONCLUSION

As part of this project, the use of a three-phase inverter with three switches could be successfully completed. The integration of this inverter allows us to achieve power improvement, voltage utilization factor, pure sinusoidal output and reduced harmonic distortion design complication only in six switches and four switch inverters. The use of the induction motor also widens the possibility of increasing this model in case of industrial application.

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