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Power Factor Correction of Three phase PWM AC Chopper Fed Induction Motor Using Hysteresis Band Current Control.

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Abstract - *In this paper a control strategy to improve input power factor of an Induction Motor using hysteresis band current control method has been proposed. Power factor correction is carried by frequently forcing the actual three phase supply current with corresponding reference current, which is in phase with voltage of supply. For this developed current to get into phase with supply voltage HBCC is implemented to get Two gate pulses for AC chopper which comprises of only 4 semiconducting devices. As a result the system is simple , proficient and moderate cost effective.*

Key Words: **PWM, AC Chopper, Hysteresis band current control.**

1. INTRODUCTION

Induction motors are the most widely used electric motors in the industry. It does not need any starting circuit . The most extensively utilised electric motors in the industry are induction motors. There is no requirement for a beginning circuit. The power factor at the start is quite low due to the motor's extremely inductive nature. As a result, reactive power is the most effective component for improving the system power factor while starting a motor. The initiation of motor method has become the subject of research in recent years. The Direct On-Line method, Star-delta, Auto-transformer, soft starter, and VFD are all examples of induction motor starting methods. There are many methods to analyse and reduce the disadvantages occurs because of low power factor. In this topic the IM fed from the three phase pulse width modulation (PWM) AC chopper (voltage regulator) is proposed.

The purpose of this method is to achieve power factor correction (PFC) of IM system. For attaining the desired objective we have used HBCC technique (Hysteresis Band Current control) which is actuated by comparing the actual current with the reference current. The paper has been organized in following sections.

1.1PWM AC Chopper

AC chopper or AC regulator gives varying amplitude of voltage so it can be considered as voltage regulator. For the chopper used in this method only four IGBT's are used to make the system reliable and compact. As the duty ratio of chopper IGBT's changed the RMS value of motor voltage is changed and hence the voltage and speed of motor is adjusted.

The duty ratio of Ac chopper is

D= Ton/Tsw

Where Tsw is switching time that is equals to Ton + Toff. The Tsw is calculated by formula

Tsw=1/Fsw

Where Fsw is frequency of switching of chopper.

For triggering the IGBT's the gate pulses are generated using HBCC.

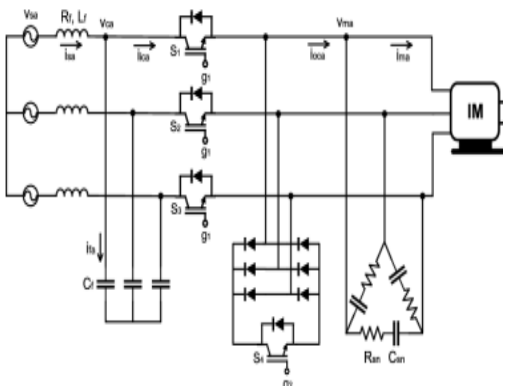


Fig-1.1: AC chopper diagram

The fig 1.1 shows the AC chopper configuration which is implemented for proposed scheme. The switches S1, S2,S3 are connected to motor and switch S4 is connected in parallel with universal bridge for freewheeling purpose which will discharge the energy stored in the induction motor winding. A three phase snubber circuit in delta connection is designed with resistance Rsn per phase and capacitance Csn per phase for reducing voltage spikes at stator of induction motor.

1.2 Hysteresis Band Current control

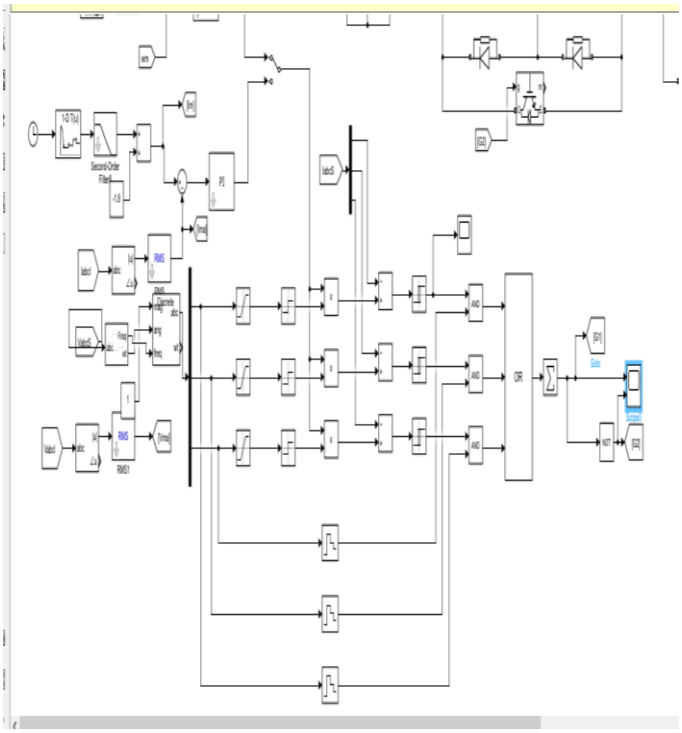
The PWM is a technique used to dampen the effects of noise on the input signal. PWM technique is applied to switching

states of semiconductor element. PWM is control of width of pulses to obtain desired value of output. The control system applied for noise reduction of AC chopper is HBCC.

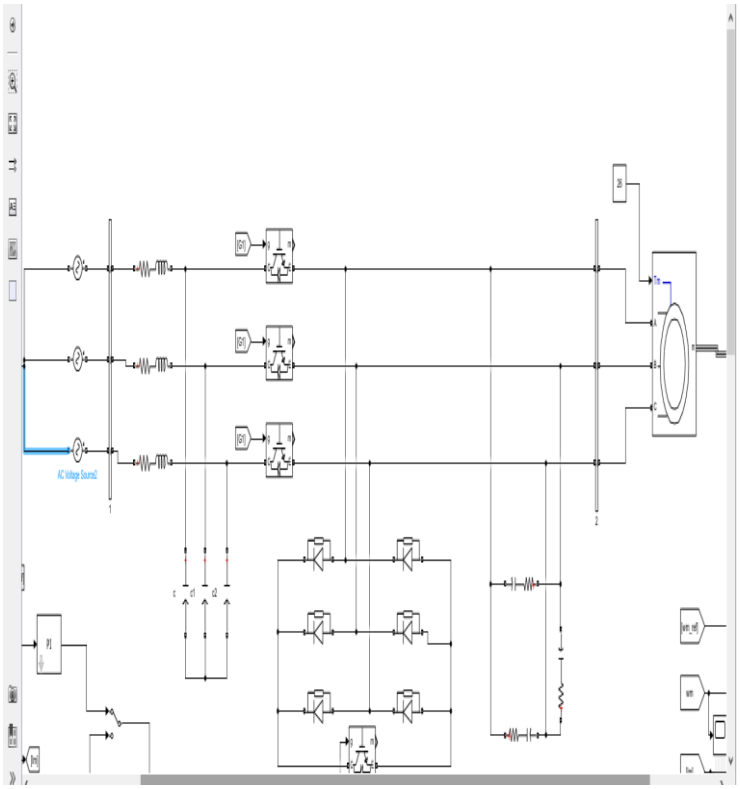
HBCC is a PWM method of instant feedback current control. In this method the actual current keep tracking the command current in a given hysteresis band. The phase currents of motor are compared to a sine reference wave of the desired size and frequency generated by the control circuit. The switches turned off when the current exceeds the required hysteresis band, and vice versa. In the specified hysteresis band, the actual currents are forced to track the sine reference wave

3. SIMULATION MODEL

3.1Control logic simulation-



3.2 Power circuit simulation-



4. RESULTS

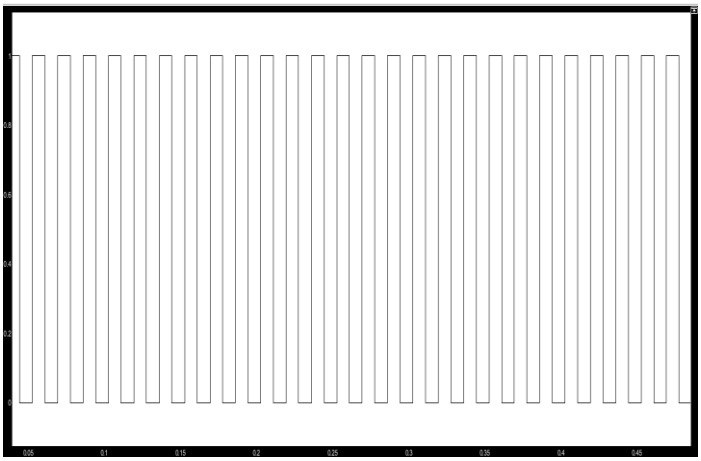


Fig-4.1:Gate Pulse 1

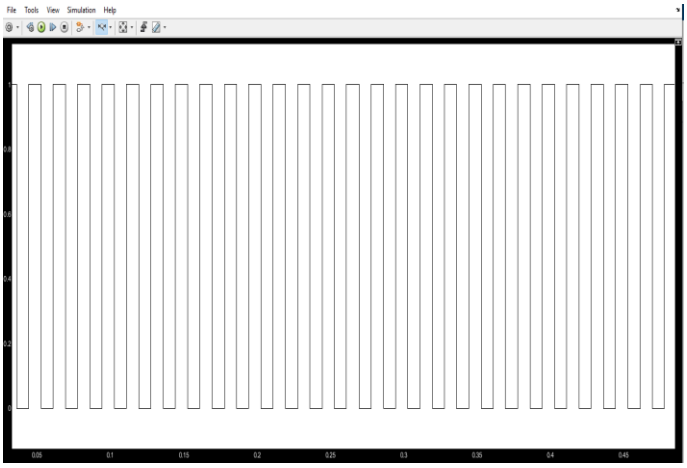


Fig -4.2: Gate Pulse 2

Fig 4.1 and 4.2 shows gate pulses generated for IGBT's operation by using HBCC pwm method for AC chopper

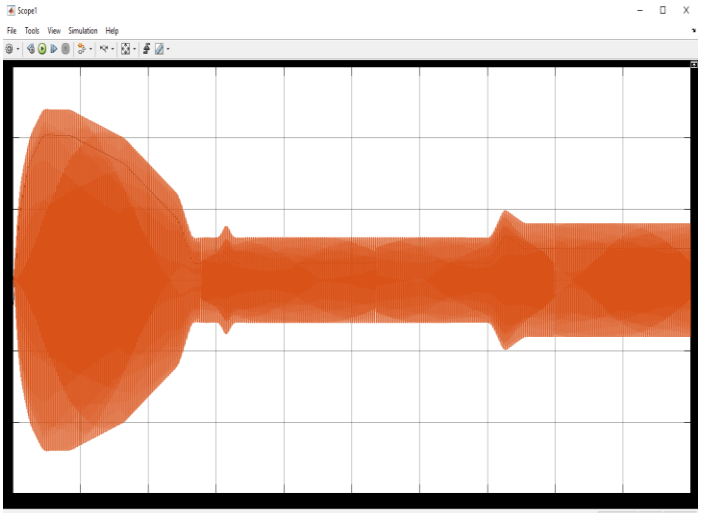


Fig- 4.3: Motor Current

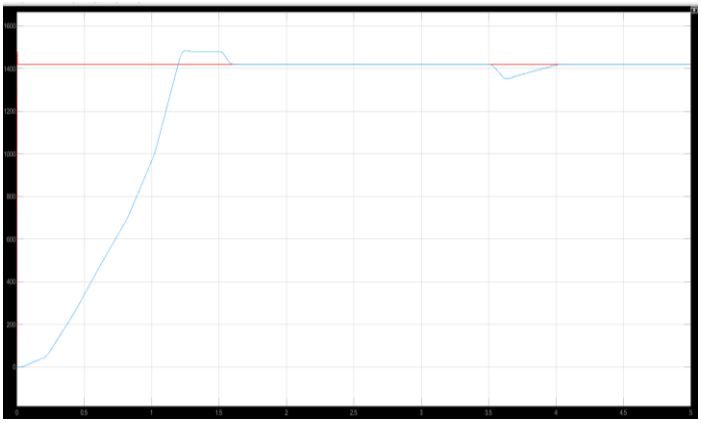


Fig-4.4: Wm (speed of motor)

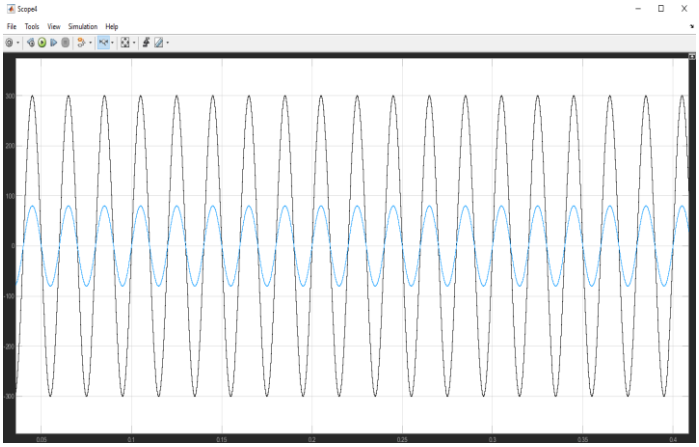


Fig-4.5: chopper voltage and current ouput

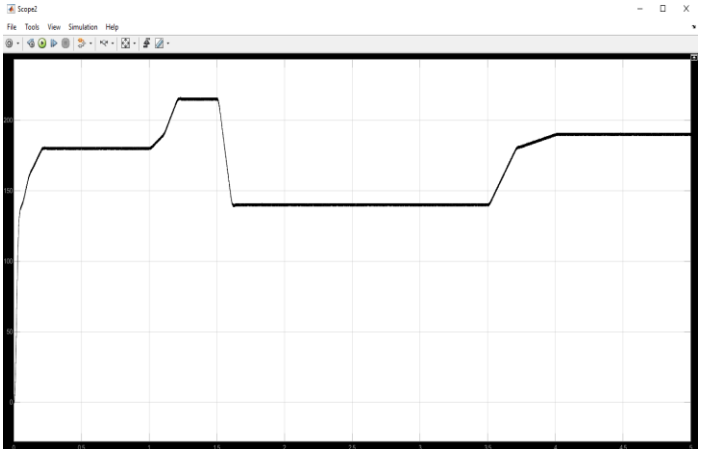


Fig -4.6: Vma(output motor voltage)

4. CONCLUSION

The main objective of this control scheme is to accurate power factor in different operating condition of induction motor. The input power factor is corrected by forcing actual current to follow reference current in given band (HBCC), this HBCC will generate Two PWM gate pulses for IGBT chopper and the chopper will give required voltage to motor to work efficiently and attain precise control and the power factor correction is achieved.

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