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ENHANCING POWER QUALITY: POWER FACTOR CORRECTION OF THREE-PHASE PWM AC CHOPPER-FED INDUCTION MOTOR DRIVE SYSTEM USING HBCC TECHNIQUE

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ABSTRACT: This thesis describes a novel strategy for regulating a three-level pulse width modulation (PWM) air conditioning chopper-supplied induction motor (IM) using fuzzy modern technology and hbcc. The proposed manipulation approach aims to stabilize the IM force apparatus's entrance energy variable (PFC) across a variety of operational conditions. PFC is achieved by sequentially applying three-segment supply currents. Currents are generated by phasing the hysteresis-band-current (HBCC) method with the source voltages. There are concerns about the proposed management style both within and outside the business. The duration for which the velocity controller or starting controller provides the referral current is determined by the external vulnerability. The air conditioning chopper's PWM pulses are established via the internal vulnerability. It is advised that four IGBTs with the most basic PWM gate indications be used in the air conditioning helicopter. As a result, the activity of the semiconductor buttons should be minimized. To summarize, the circumspect method is successful, moderately priced, and easy to understand. MATLAB/SIMULINK was used to configure and test the IM power source.

Keywords: IM, PFC, IGBT, HBCC, PWM, Matlab.

I. INTRODUCTION

Air conditioning voltage controllers, often known as air conditioning voltage control devices, are useful for more than just adjusting AC voltage. These bundles include industrial ventilation, pace modulation, soft start, and lighting switches with dimmer circuits for induction electric vehicles and residences . In the eyes of these regulators, single-action and three-stage plans are distinct types with different management methodologies. The air conditioning voltage driver changes the root mean square (RMS) cost of the loading circuit's output.

Three management strategies can be employed to achieve this goal: ON/OFF, section attitude (PA), and pulse width modulation (PWM). All three manipulation methods are applicable to both single- and three-section procedures. Thyristors, also known as silicone-controlled solutions, are electrical valves that switch manipulator tools on and off. It is always their responsibility to connect and unplug the ton circuit from the AC power supply.

Before it was broken, the link was established over several item cycles of subsequent feeding voltage cycles. The RMS output voltage may vary due to closed or clogged holes. The ON/OFF approach reduces harmonics by switching silicon controlled rectifiers (SCRs) on and off at zero voltage. It is still feasible to produce undesirable subharmonic components.

Domestic temperature and heating controls are the most user-friendly packages for this system. They also have the widest delivery gap when call volumes are low. The adjustment method alters the angles at which the SCRs are collected, hence controlling how the AC voltage controller functions. A single-section regulation PA control authority's strength circuit consists of two conventional thyristors connected to the power supply and the load tool. Three-phase control devices have three sets of standard thyristors (SCRs).

The amounts The smooth starting point of an induction motor (IM) powered by a thyristorized voltage controller is depicted in sources.The engine's voltage is artificially maintained by adjusting the torque controls and thyristor exposure angles at various working pressures.describes a tension ramp method for starting an AC electric motor. During starting, the SCR capture angles are altered using ramp technology to increase the voltage significantly. Using a current closed loophole control method determine the thyristor firing angles required to keep the engine operating immediately during start-up while remaining below a cost restriction. Using these procedures, you can begin the instant chat without any issues.

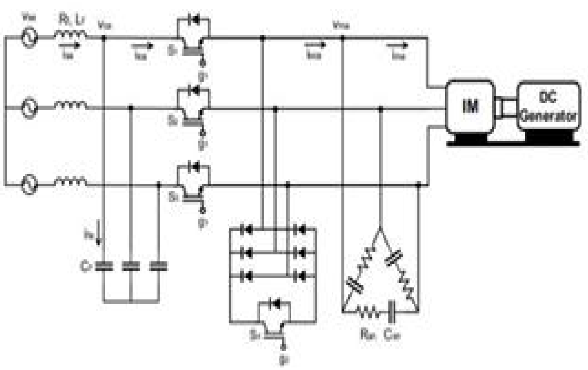
These elaborate and expensive controls are comprised of numerous zero crossing detection circuits and sensing devices. Furthermore, despite the fact that many harmonics are totally repulsive, the transistorized AC voltage driver requires a smaller PF. Modern semiconductor buttons, such as MOSFETs and IGBTs, can replace SCRs due to their modern semiconductor strength switches. Modern PWM control methods for changing electricity may improve the air conditioner's voltage control power in terms of harmonics, filter range, input PF, and voltage manipulation range.

II. PROPOSED SYSTEM

This study employs HBCC technology from a three-phase squirrel cage IM to demonstrate a new method for controlling the PFC of a three-phase PWM AC chopper. The working modes include soft beginning and speed limitation. Because there are fewer power semiconductor switches, the power circuit for the suggested management approach is simple to grasp, reliable, highly effective, and reasonably priced. Three IGBTs comprise the three phase PWM AC chopper. To run the four IGBTs, a new closed-loop control approach requires only two gate pulses.

The suggested control approach has three basic control goals: input PFC, speed control, and soft start. These objectives can be achieved by adjusting the RMS value of the voltage delivered into the IM contacts. The proposed control approach is tested in a variety of scenarios, and simulation results are obtained. We test the proposed control strategy on a lab prototype model. There includes a four-switch PWM AC chopper, a DSP DS 1104 control experimental board, and a 1.5 HP squirrel cage IM that loads directly from a DC generator.

The waveforms discovered are compared to those observed in models. Here's how the remainder of the composition is assembled: First, the working styles and a description of the proposed control technique are discussed. The proposed control approach is next examined mathematically. The paper's findings will be determined after receiving the waveforms from the lab and the computer.

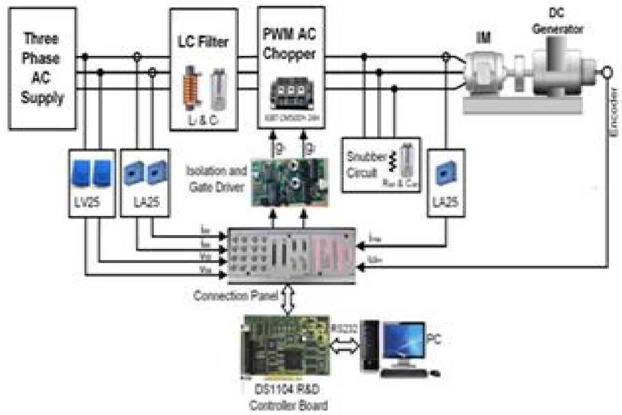


The proposed control strategy has three main control

Objectives: A constant speed, a gradual start, and power factor correction (PFC). The voltage applied across the IM terminals is altered in this manner using an AC chopper. FIGURE is a diagram illustrating how the proposed control strategy is organized. There are two control systems there.

The inner control loop uses HBCC to match the chopper's real current signals to its command current signals, allowing for input PFC. The outer control loop, on the other hand, selects the reference current value from either the starting or speed control modes. That is, the outer and inner loops determine the size and phase of the chopper currents, respectively. By sending a switching pulse to the selection switch while it is still operational, the initial function activates the speed control mode and disables the gentle starting mode.

In the MATLAB/Simulink system, a test model is utilized instead of the recommended AC chopper. Simulations may have been conducted to ensure that the proposed control strategy will function. Three study cases are examined. The simulation and study data have been carefully compiled and compared. The properties of the tool examined are listed in the appendix.



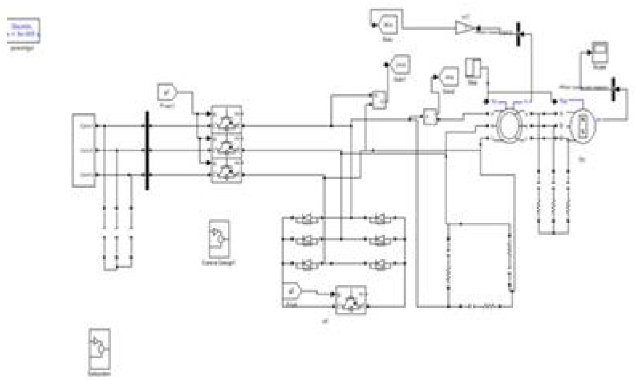


Fig.Simulation circuit.

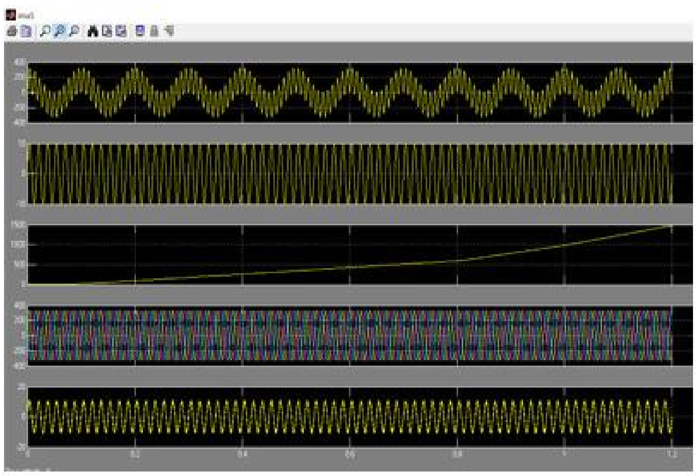


Fig. PFC of the drive system during start-up of the IM.

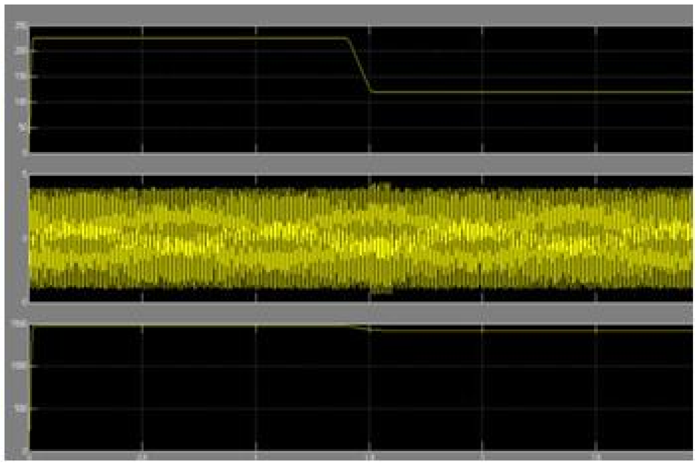


Fig. Variation of the motor speed, current and phase voltage at activation of the speed controller.

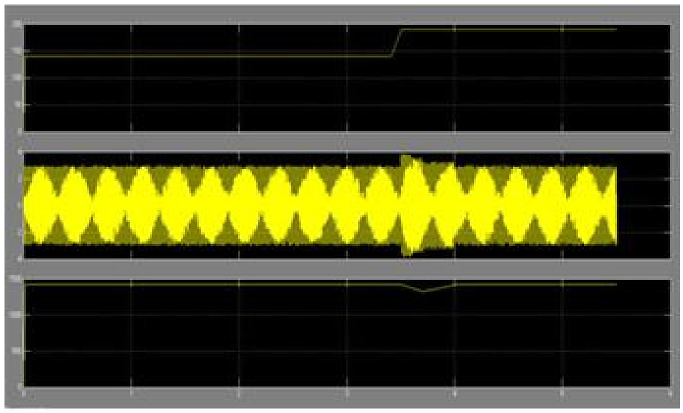


Fig. Variation of the motor speed, current and phase voltage at step change in the load torque.

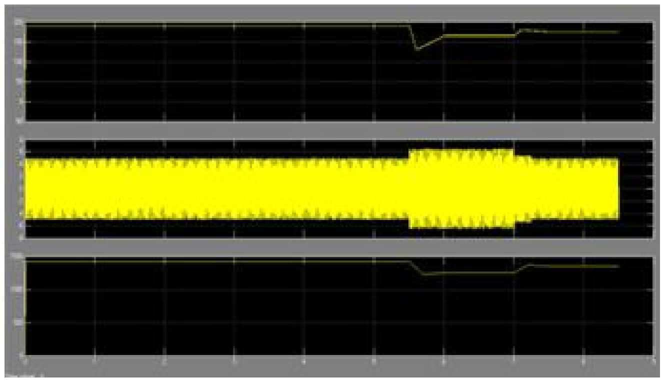


Fig. Variation of the motor speed, current and phase voltage at step change in the reference speed.

III. CONCLUSION

The control's primary function is to adjust the direction of the input PF when the induction motor's drive system operates in different modes. That is how the HBCC approach achieves input PFC: the chopper's real currents must align with their reference currents, which are in phase with the input voltage. In the proposed control scheme, the AC chop's active switches are powered by only two PWM signals. The suggested solution is simple to learn, dependable, and inexpensive; it only requires four IGBT switches. It is discussed how the proposed system operates and how its mathematical analysis functions. The structure was constructed, and MATLAB/SIMULINK was used to model the system. Changes were made to the starting point, reference speed, and load torque to determine how well the proposed control system worked. Experimental and computational study demonstrate that the proposed control mechanism works well in all test circumstances. Three test scenarios are used to acquire a general sense of how well the intended PFC approach and the PFC-free system function. As evidenced by the comparison data, the system performs better after the PF was repaired utilizing the suggested PFC approach.

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