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Simulation of Six-Step VSI Induction Motor Drive System using Fast Fourier Transform

[1]Anant G. Kulkarni, [2]Dr. M. F. Qureshi, [3]Dr. Manoj Jha
[1]Research scholar, Dr. C. V. Raman University, Bilaspur, India,
[2]Department of Electrical Engineering, Government Polytechnic, Dhamtari, India,
[3]Department of Mathematics, Rungta Engineering College, Raipur, India,

***Abstract*- This paper mainly concerned with constant 'V/f' control operation, provided by the 6-step VSI which excites the three phase stator winding of Induction Motor. The Performance analysis of induction motor has been done with the observing torque, current and speed response by matlab simulink model. The FFT used for the outputs in frequency form and results are presented.**

Key words - Induction Motor, Voltage Source Inverters (VSI) variable frequency drives (VVVF) Fast Fourier Transform (FFT), Insulated Gate Bipolar Transistor (IGBT).

I. INTRODUCTION

Induction motor‘s are playing a great vital roll in developing the industrial applications. In the last few decades, the evaluation changes induction motor has promising the controlling the speed and others parameters like torque. . Induction motor is playing a vital role in industrial development. Induction motors promising the variable speed & variable torque. The low power application has been involved by their easiness of controlling nature. With the invention of variable voltage, variable frequency drives (VVVF) the use of induction motor ere increased. Variable frequency Voltage Source Inverters (VSI's) are widely used to control the speed of 3-phase squirrel cage Induction Motors (IM) over a wide range by varying the stator frequency. The VSI's are widely preferred in industries for variable speed drive systems, driving a group of motors configured in parallel causes optimize economic cost .in recent the variable frequency drives controlling function by rectifier ,converting a three-phase voltage source to DC .

The rectifier is used to store on dc bus. The inverter section is linked with DC bus which contain the capacitor to store the power and fed to inverter .the transistor is used as driver to deliver the power to induction motor. The Insulated Gate Bipolar Transistor (IGBT) is a used in recent VFD. It offers the precise control of power deliver to motor which switching fast rate. PWM technique has been used to current simulation at particular frequency in IGBT.

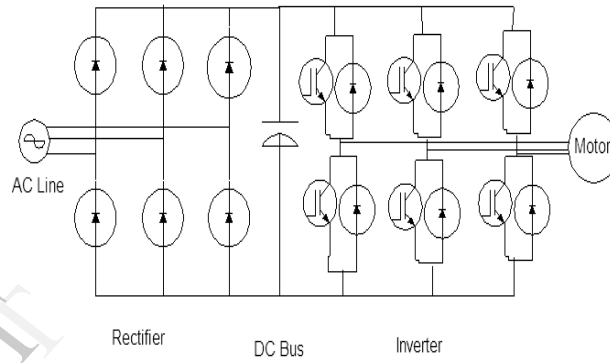

Fig.1. Block Diagram of IM Drive System

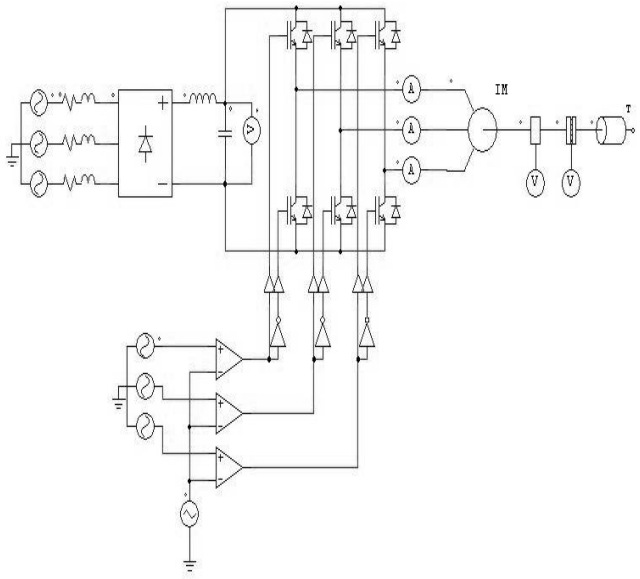

Fig.2. Simulation Model Circuit Diagram Validation of Simulation Model

The 6-step VSI excites the three phase stator winding of IM with constant V/f control function. The model has been developed and series of simulation for fault conditions are performs for open circuit, inverter and IGBT. Under these fault conditions time domain and frequency domain analyses are performed to discriminate fault types. Fig.1. shows block diagram of IM drive system.

II. SIMULATION MODEL

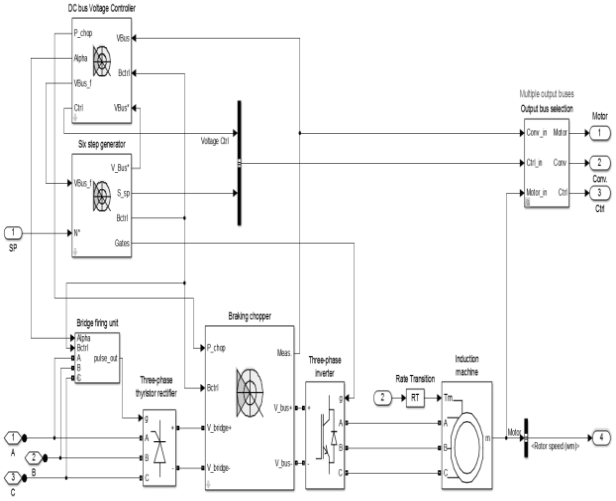

Fig. 3 Simulink Model Six-Step VSI Induction Motor Drive Block

Simulation modeling is the process of creating and analyzing a digital prototype of a physical model to analysis parameters performance in ideal case. Powersim (PSIM) has been used for simulation as shown in the Fig. 2.
This model is consist with source along with source impedance for idealization purpose are been develop. Sinusoidal pulse width modulator SPWM controller functioning the induction motor .To keep 'V/f' ratio constant, motor terminal voltage magnitude and frequency are adjusted by setting controller parameters.

The following profile has been verified by analyzing the following profiles:

1. Dynamic responses of motor drive system,
2. Steady state motor current,
3. Developed torque,
4. Supply current

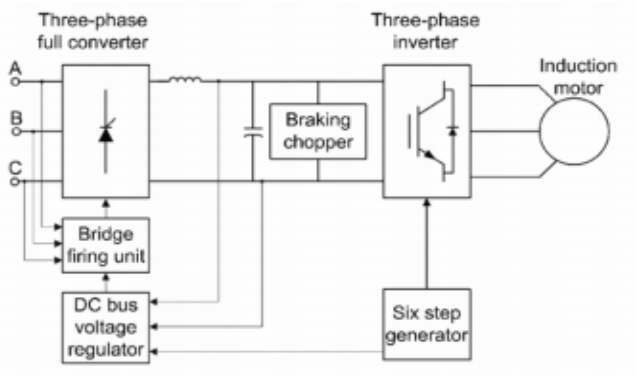

Fig. 4 Six Step VSI Block Diagram

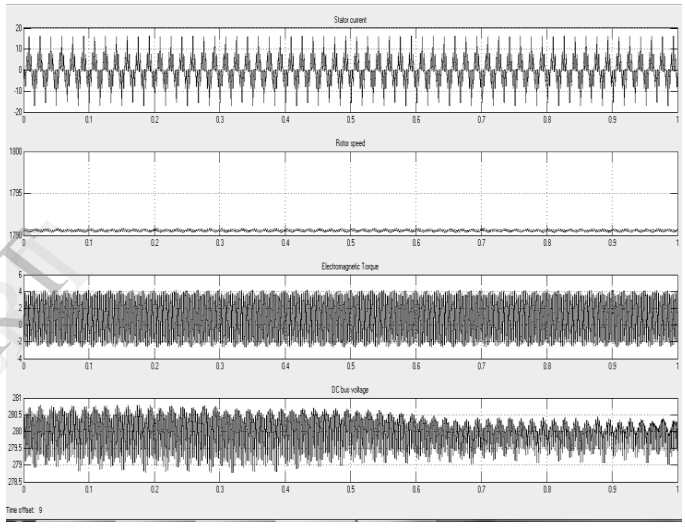

Fig. 5 Time Domain Output Waveform of Six Step VSI Drive

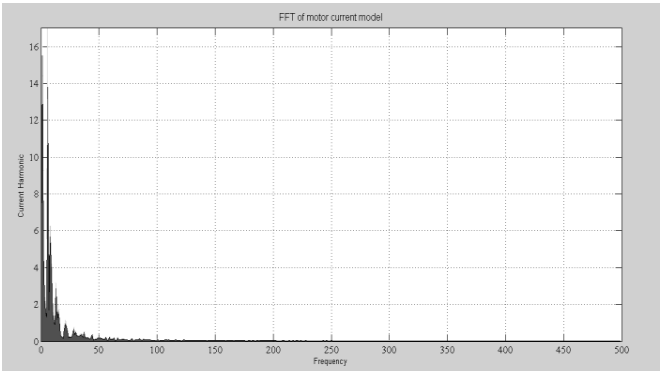

Fig.6. Frequency Domain Result of Motor Current of Six Step VSI With FFT Model

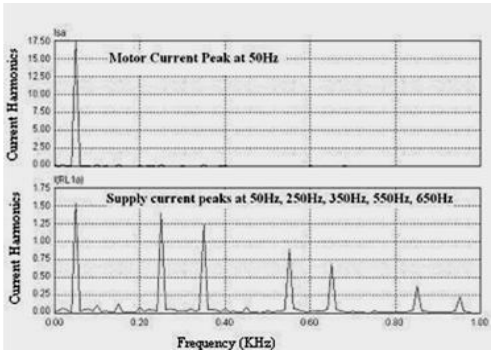

Fig.7. FFTs of Induction Motor Current and

Supply Current of Model

III. SIMULATION RESULT ANALYSIS

It can be concluded by simulating said profiles the model is unambiguous. Fig. 5 shows time domain waveform of six step VSI model of induction motor drive. After simulation connects FFT for only current parameter and Fig. 6 is frequency domain waveform of six stem VSI induction motor drive for current waveform. FFT also analyze. In the Fig. 7 depicted FFTs of supply current of the model and motor current. The Harmonics has been canceled respective order due to the power supply is 3 phase, the third order harmonics cancel each other out in each phase.

IV. CONCLUSION

Hence the simulation model is acceptable and can be considered as a healthy motor-drive system. The magnitude of the harmonics produced by a VFD is greatest for the lower order harmonics (5th, 7th and 11th) and drops quickly as we move into the higher order harmonics (13th and greater).

V. ACKNOWLEDGMENT

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VI. REFERENCES

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