ANALYSIS OF VARIABLE SPEED CONTROLS OF 3-PHASE INDUTION MOTOR WITH ESTIMATED CHARACTERISTICS

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Abstract- This study presents a new energy efficient V/f speed manipulate of three-phase induction motor,with a new technique of velocity manage and speed for the three phase induction motor, over the hazards of the conventional methods. In this proposed new method, the importance of the main Winding contemporary and its perspectives are managed to govern the motor velocity, as well as to growth the starting speed Torque at all speed settings.An intense learning machine technique is used to acquire selective harmonic elimination pulse width modulation.The objective is to regulate the velocity of the three phase induction motor, casting off Undesired low-order harmonics. Novel Algorithm has been proposed using matlab /Simulink so that high-speed edition can be obtained even at Low- and high-velocity regions. The effects showed the effectiveness of the proposed technique. The reduction within the general harmonic with certain speed at different ranges and distortion is achieved in all operation variety of v/f speed manage.

Keywords: *3 Phase induction motor, PWM, SVPWM and Speed control.*

1. INTRODUCTION

Three phase Induction motors are widely used as industrial drives due to the fact they're rugged, reliable and cost-effective. Although traditionally utilized in fixed-speed carrier, induction motors are increasingly getting used with variable-frequency drives (vfds) in variable-velocity carrier. Vfds offer specially critical strength savings opportunities for existing and potential induction motors in variable-torque centrifugal fan, pump and compressor load programs. Squirrel cage induction motors are very widely used in each fixed-speed and variable-frequency force (vfd) programs.

The technique of converting the course of rotation of an induction motor relies upon on whether or not it is a 3-phase or single-phase device. In the case of three-phase, reversal is straightforwardly implemented by way of swapping connection of any phase conductors.3-phase induction motors are widely used in industrial applications for continuous operations.In terms of practical application,A 3 phase induction motor is basically a constant speed motor so it’s somewhat difficult to govern its speed. The velocity manage of induction motor is performed at the cost of decrease in efficiency and low electrical strength

aspects.The techniques to manipulate the rate of 3-phase induction motor,onehave to recognize the fundamental formulas of velocity and torque of 3 phaseinduction motor because the methods of speed manage depends upon those formulas.

Synchronous speed

$$N_s = \frac{120f}{P}$$

Where, p is no.of poles, f is frequency.

The speed of induction motor is given by,

$$N = N_s(1 - s)$$

Where, N is the speed of the rotor of an induction motor, N_s is the synchronous speed, S is the slip.

The torque produced by three phase induction motor is given by,

$$T = \frac{3}{2\pi N_s} X \frac{sE_2^2 R_2}{R_2^2 + (sX_2)^2}$$

In this proposed work, the properties of 3-phase Induction motor is proposed with the characteristics of its speed power factor and its torque efficiency.The power factor of 3-phase induction motor varies with load, usually from around 0.85 or 0.90 at full load to as low as approximately 0.20 at no-load, because of stator and rotor leakage and magnetizing reactances, power factors may be improved by connecting capacitors either on an individual motor basis or, by using choice, on a common bus overlaying several motors. For economic and other considerations, strength structures power factor are corrected to unit power factor component. Power capacitor application with harmonic currents needs power system analysis to avoid harmonic resonance between capacitors and transformer and circuit reactances.Full load motor efficiency varies from about 85% to 97%, related motor losses being damaged down more or less as follows:

Friction and windage, 5–15%

Iron or center losses, 15–25%

Stator losses, 25–40%

Rotor losses, 15–25%

Stray load losses, 10–20%.

Various regulatory authorities in many nations have delivered and implemented law to inspire the manufacture and use of higher efficiency electric powered motors. There's existing and imminent legislation concerning the future obligatory use of top class-efficiency induction-kind motors in described system.

II.OPERATIONAL PRINCIPLE OF 3-PHASE INDUCTION MOTORS

In both induction and synchronous motors, the ac energy furnished to the motor's stator creates a magnetic discipline that rotates in synchronism with the ac oscillations. Whereas a synchronous motor's rotor turns at the equal charge because the stator field, an induction motor's rotor rotates at a particularly slower speed than the stator field. The induction motor stator's magnetic discipline is therefore converting or rotating relative to the rotor. This induces an opposing contemporary in the induction motor's rotor, in impact the motor's secondary winding, whilst the latter is short-circuited or closed via an external impedance. the rotating magnetic flux induces currents inside the windings of the rotor; in a way just like currents brought about in a transformer's secondary winding(s).

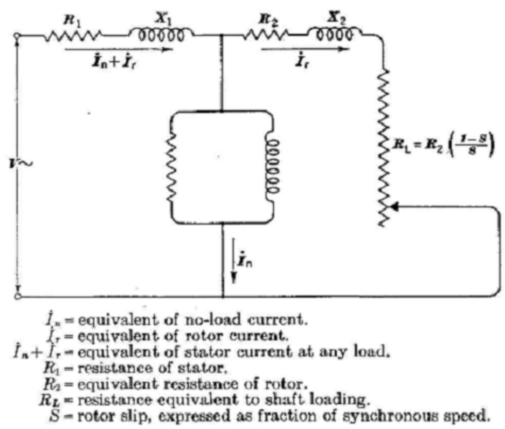
The induced currents within the rotor windings in flip create magnetic fields For rotor currents to be caused, the velocity of the physical rotor have to be lower than that of the stator's rotating magnetic field in any other case the magnetic field might now not be transferring relative to the rotor conductors and no currents would be induced.

As the speed of the rotor drops below synchronous speed, the rotation cost of the magnetic field inside the rotor will increase, inducing more cutting-edge within the windings and creating greater torque. The ratio among the rotation speed of the magnetic field prompted inside the rotor and the rotation rate of the stator's rotating field is called "slip". Beneath load, the speed drops and the slip increases sufficient to create enough torque to turn the loadwithin the rotor that react in opposition to the stator field.

III.STIMULATION RESULTS AND CALCULATIONS

3.1.Equivalent derivative

To expose the proposed analysis of an three phase induction motor is with its equivqlent circuit , utilized in fixed-speed carrier, variable-frequency drives (vfds) in variable-velocity carrier.



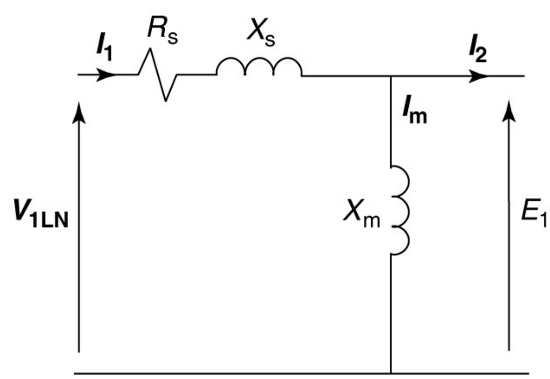


Figure1.Induction stator Equivalent Circuit

Searching on the stator circuit of figure 1, i1 is the cutting-edge getting into the winding. As already mentioned, a considerable contemporary im, is required to establish the magnetic field. The final contemporary, i2, is the weight part of the stator modern. The mmf of i2 will precisely cancel the mmf of the rotor current. In phasor notation, we will write,

V1 = e1 + i1(rs +jxs)(1)v1 = e1 + i1(rs +jxs)(1)

In which e1 is the emf brought about in the stator coil by way of the mutual flux. We need to add the rotor to the equivalent circuit.

3.2 Simulated output

A computer program changed into advanced to calculate the overall performance characteristics of the motor. In fashionable, the implemented voltages to the primary and aux- iliary windings are different, and the program takes this into attention. The equivalent circuit parameters of the experimental motor are calculated the usage of the consequences of the no-load and locked rotor tests after which modified the usage of the whole load check effects. These parameters are then used inside the pc application. The version of the magnetizing reactance (xm) with working states due to saturation is taken into consideration.

The simulation program is then used to gain the motor performance traits when the manipulate factor is connected either in series with speed control variables with varying speed RPM.The motor or in series with the principle winding only. The simulation effects are in correct exposure with the experimental effects. Those effects are shown in figs. 2–l2.

Reference speed at 1800 RPM

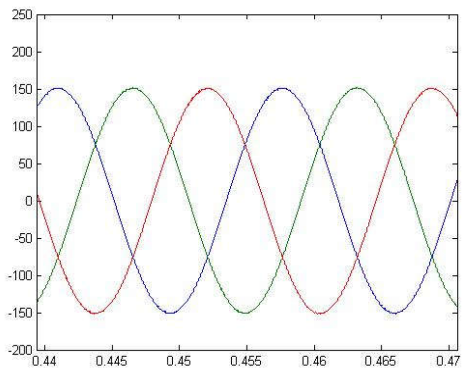


Figure.2 Stator Voltage in volt

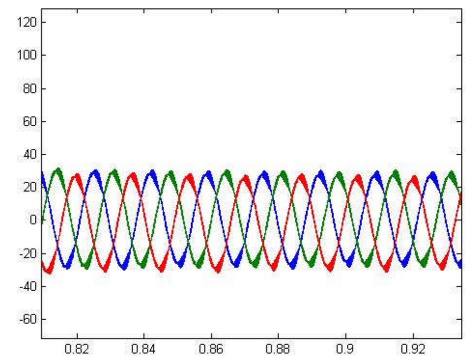


Figure.3 Stator current in Amps

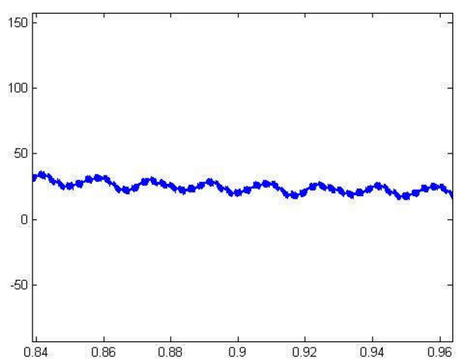


Figure.4 Torque in N-M

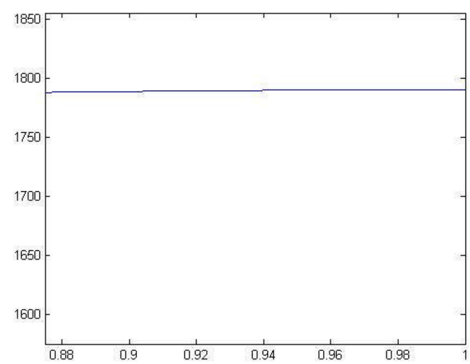


Figure.5 Speed in RPM

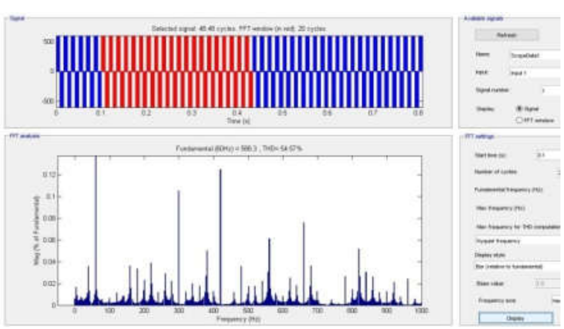


Figure.6 THD Computation.

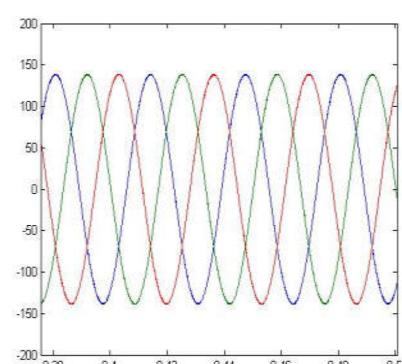


Figure.7 Stator voltage in volts

Reference speed at 900 RPM

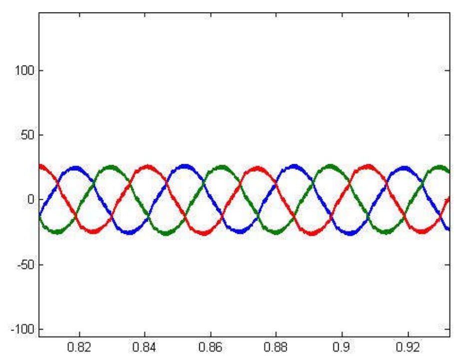


Figure.8Stator current in Amps

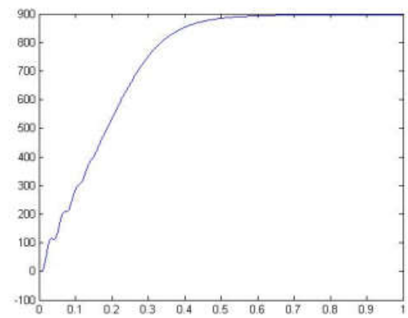


Figure.9.Speed in RPM

V

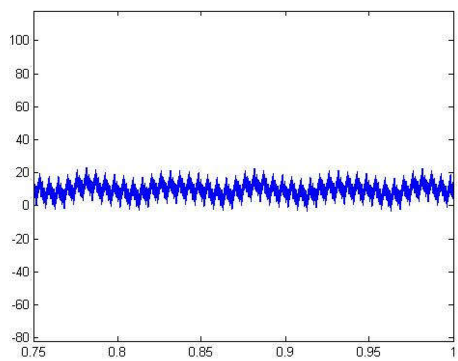


Figure.10 Torque inN-M

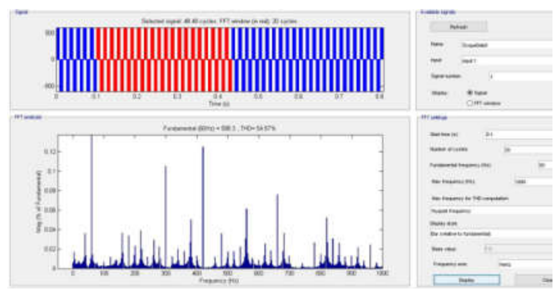


Figure.11 THD Computation

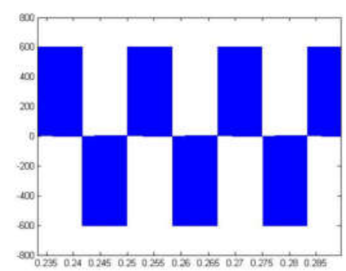


Figure.12 Voltage analysis

Table: Copmparision Tabulation for Speed control variations

SPEED CONTROL VARIATIONS	
Speed at 1800 RPM	Speed at 900 RPM

Max Freq Range---1000hz Freq for THD Computation---Nyquist Freq Fundamental Freq---50hz Voltage Range---(-140V to+140V) Current Range----(-30 to +30 Amps) Torque---(0 to 30 newton) Speed---Constant at 1790m/sec	Max Freq Range---1000hz Freq for THD Computation---Nyquist Freq Fundamental Freq---50hz Voltage Range— (-140V to +100V) Current Range----(-10 to +25 Amps) Torque---(0 to 20 newton) Speed---Constant at 900m/sec

IV.CONCLUSION

A new proposal for speed manipulate of 3-Phase induction run motors is introduced. The proposed new method controls the modern-day induction motor within the essential winding circuit handiest. The auxiliary circuit modern is stored at its rated result value. The method can be applied through using either a variable reactance or a digital circuit in connection with the principle winding. This approach has the following benefits while in comparison with conventional methods.

1. Unlike single phase motors, a three phase induction motor has an excessive beginning torque, better velocity regulation and affordable overload capability.

2. An induction motor is a exceedingly efficient device with complete load efficiency various from 85 to 97 percentage.

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