# Comparisons between different method for improving efficiency Induction Motor

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## ABSTRACT

The basic contrast between different type of algorithm like neural fuzzy interface system (ANFSI), optimization algorithm, two phase IM based adopter system model, PI controller (NNPIC), Novel neural network for PWM technique. In this paper also study multi level inverter with improved efficiency parameter and reduced harmonic distortion with high speed trigging IGBT circuit. The basic methodology to enhancement of induction motor parameter by using PWM technique and optimization efficiency method.

**Keywords:** Neural Network; Fuzzy Logic Controller (FLC), Efficiency Optimization, Adaptive Controller, Neural Network PI Controller, Sensor less Control, Induction Motor.

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## INTRODUCTION:

The induction motor is widely used in the electrical drive system. Vector control method is used to control speed of three phase IM. It also controls flux independently. Vector control technique has two method direct and indirect vector control method [1]. The torque has been depending from flux and direct current flow through in inverter. This method has been improved conventional fuzzy logic controller (FLC) current and speed parameter. Single phase induction motor is widely used in residential, industrial applications. Unbalanced space vector PWM methods for classical scalar control of a two phase asymmetrical IM in order to improve performance [2]. This motor is known variously as SPIM , six-phase induction motor , asymmetrical six-phase induction motor , dual stator induction motor and dual three-phase induction motor .There are various method for controlling IM. In scalar control the dynamic response is poor. To overcome this difficulty by vector control of IM [3]. Variable frequency drive are more popular in variable speed services because variable frequency drive are more energy saving device [4].In this paper have four methods to improved motor synchronization of induction MOTOR.

**VECTOR CONTROL APPROCHE**

The dynamic model of an induction motor (IM) is essential for the development of a high performance induction motor drive system and higher controlled circuit design. As far as the steady state model of induction motor is concerned, it can only help in determining the steady state torque, current, various losses in induction motor, efficiency etc these parameter basic criteria of single phase induction motor. The dynamic model of the induction motor is based upon the orthogonal currents id and iq obtained from the transformation of the three phase stator current into two orthogonal DC vectors, derived from Park's transformation, in a rotor reference frame.

The aim of the vector control is to control the induction motor in a similar fashion to that of a separately excited DC motor. In DC motor, the armature current is responsible for controlling the torque and the field current is responsible for controlling the flux of the motor independent of each other. This independent control of torque and flux quantities can also be exhibited in case of an induction motor through decoupling, possible only when the three line currents (ia, ib, ic) are transformed to two orthogonal DC quantities (id and iq). Vector Control also allows the control of phase in addition to magnitude and frequency. The flux is independently controlled through direct current component id and the torque is controlled by controlling the quadrature current component iq.

In a vector control strategy, the *d-q* frame rotates along with the rotor flux (which is maintained at its rated value). The *d-axis* is aligned with the direction of the rotor flux which makes the *q-axis* component of rotor flux null and the expression of the electromagnetic torque simplifies as follows

$$T_E=\frac{3}{2}\frac{p}{2}\frac{l}{L}\psi_{qr}i_{qs}$$

$$\Theta= \int(\dot{\omega}_r+\dot{\omega}_{sl})dt$$

The speed controller is required to generate the reference torque *Te**, which is necessary for generating the reference current *iqs** necessary for speed control. The speed controller processes the error from the reference speed and the measured speed and accordingly provides an appropriate control signal.

### Enhancement Efficiency technique

Enhancement Efficiency technique Using an optimization algorithm, it is possible to improve the efficiency of the drive system. This is possible through the reduction of power losses obtained through weakening of the rotor flux. The power losses in case of an induction motor are due to stator and rotor copper losses, core loss and mechanical losses (windage and frictional).

Space vector based PWM: This section briefly reviews three existing SV PWM techniques, whose performances are evaluated and compared with carrier based PWM techniques in later sections.

### NEURAL NETWORK VECTOR CONTROL ARCHITECTURE ALGORITHM

The proposed NN vector control architecture for the induction motor is shown in Fig. The NN implements the fast inner current-loop control function. Due to the universal function approximation property, NN vector control, unlike conventional vector control, has the ability to achieve true decoupled torque and flux control. The outer control loops still utilize PI controllers and *q*-a is loop is used for speed control as shown.

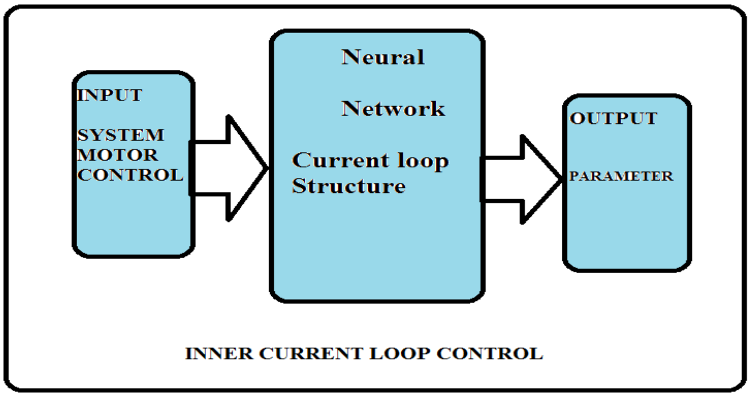


**Fig. 1 Inner current loop control**

### Speed controlling in Neural Network

As seen from expression above rotor speed can be controlled by changing pole. Poles can be changed using multiple stator windings, pole amplitude modulation etc. This method of speed control is not recommended since poles are generally fixed for induction machine. Apart from this, stator voltage control and supply frequency control are methods for speed control in these methods stator voltage is controlled with the help of ac voltage regulator and supply frequency is controlled using cycloconverters respectively.

## Result of Neural Network controlling Algorithms

Given the speed control loop bandwidth αω of 0.5rad/s, the rise time of the speed response is supposed to be 4.4 sec, which can be noticed in the simulation response in By contrast, the practical response appears relatively slower than it should at the beginning. However, as it is approaching steady state it gets a larger acceleration than the simulation curve does, which causes an unnoticeable overshoot. Several causes could contribute to the difference between the simulation and experimental results. One of the potential reasons is that the reference torque generated by the speed controller is less than it should be, as a result of inaccurate speed sensing, incorrect motor parameters or inadequate coefficients of the speed PI controller. Since the gains of the speed PI controller are determined by the motor inertia J and friction coefficient B as well in IMC (Internal Model Control), it also can be affected by incorrect motor parameters. The other factor leading to this result could be inaccurate flux estimation, which could be induced by speed measurement ripple or incorrect motor parameters that are involved in the flux estimator design. Because the estimator designed in this control system is the current model, whose greatest drawback is parameter sensitivity, the variation of the parameters will affect the flux estimation significantly. The error between the estimated and the actual flux will lead to a wrong calculation of the reference of the q current, which will cause a series of chain reactions. With the assumption that current control loop has a perfect performance.

## PWM TECHNIQUE CONTROLLING INDUCTION MOTOR

With advancement in the field of power electronics the control of Electrical machines become easier and precise. Though there are various methods of speed control for an induction Motor. The most economical and effective among these which are widely adopted by the industries are Scalar control and direct torque control Method. Scalar control methods are better for industries where precise and dynamic control of induction motor is not required. Compared to speed control methods such as variable voltage control and variable frequency control this method is far better in terms of operating performance, economy and it also offers wide range of speed variations. Features of Scalar Control of induction Motor also include low starting current requirement. Modeling of scalar control method is done through Simulink feature of MATLAB Software. In the proposed modeling approach open loop model of scalar control method for induction motor is implemented.

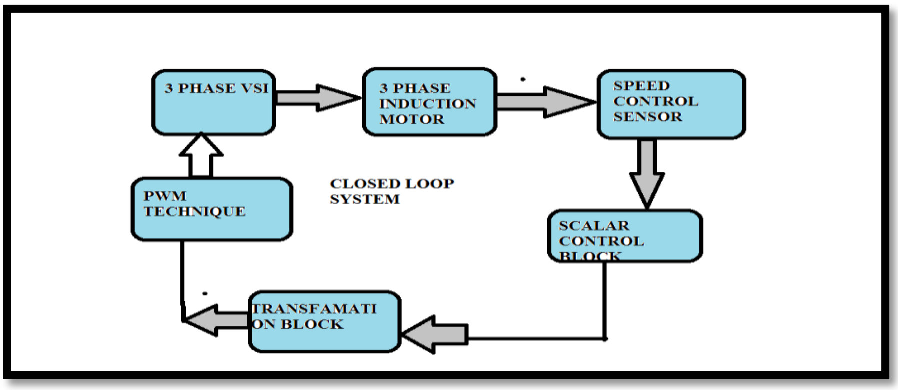


**Fig. 2 Closed loop PWM Induction motor controlling**

**Efficiency Parameter:** The use of PWM vector control method the efficiency of induction motor drive is improved. It can also be seen that the starting efficiencies high with the vector control method, indicating that the starting characteristics of the motor have improved. Hence the overall power losses in the system have reduced.

**VECTOR CONTROL OPTIMIZATION APPROCH**

1. The frequency *e* ω of the drive is not directly controlled as in scalar control. The machine is essentially self controlled where the frequency as well as the phase are controlled indirectly with the help of unit vector.
2. There is no fear of an instability problem by crossing the operating point beyond the breakdown torque *em T* as in a scalar control. Limiting the total *s I* within the safe limit automatically limits operation within the stable region.
3. The transient response will be fast and dc machine like because torque control by *qs i* does not affect the flux. However ideal vector control is not possible in practice, because of delays in converter and signal processing and the parameter variation effect.
4. Like a dc machine, speed control is possible in four quadrants without any additional control elements like phase sequence reversing. In forward motoring condition, if the torque *e T* in negative, the drive initially goes into regenerative braking mode, which slows down the speed. At zero speed, the phase sequence of the unit vector automatically reverses, giving reverse motoring operation.

**Simulink Modeling by vector controlled PWM technique:**

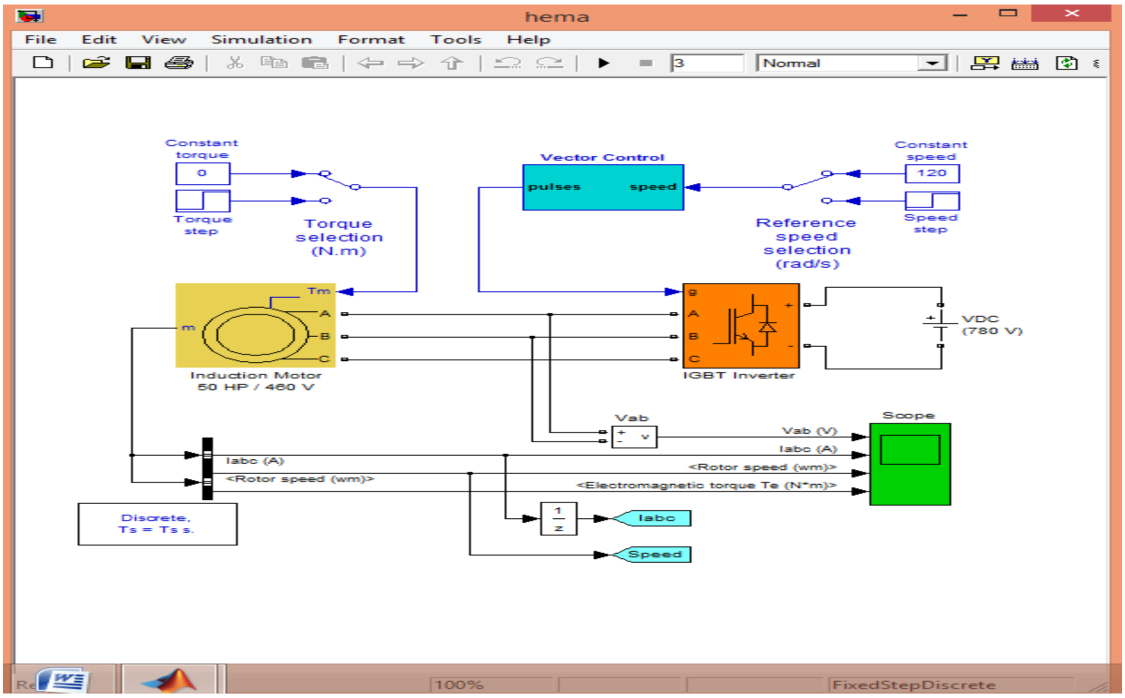


**Fig. 3 Simulink Model**

**Output waveform of Fixed offset time:**

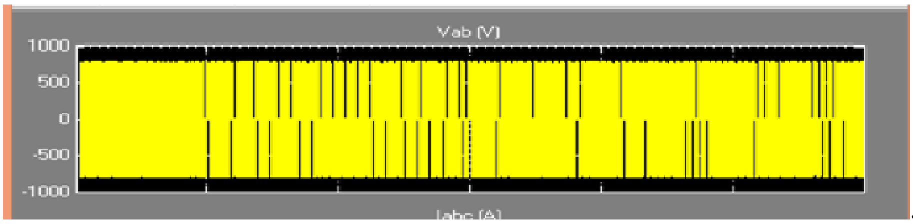


**Fig. 4 Amplitude voltage(V) Vs Offset Time**

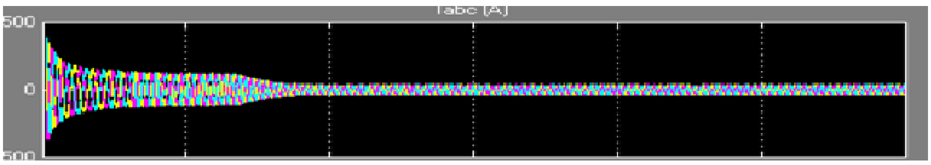


**Fig. 5 Amplitude current(A) Vs Offset Time**

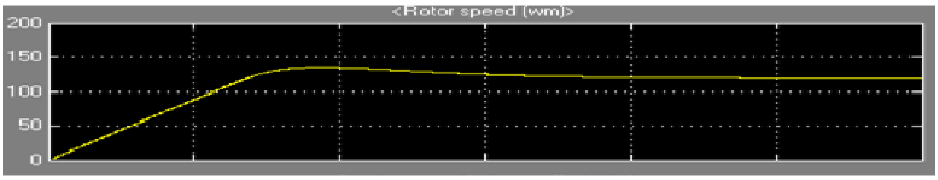


**Fig. 6 Amplitude rotor speed (rpm) Vs Offset Time**

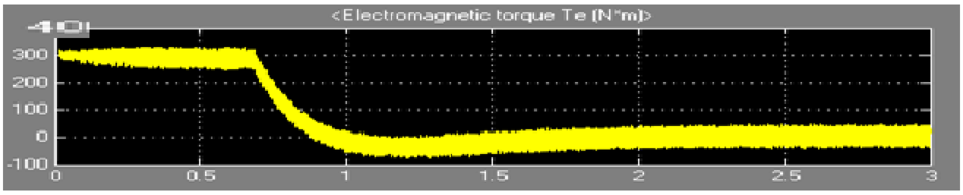


**Fig. 7 Amplitude Electromagnetic torque Te (Nm) Vs Offset Time**

**TABLE I**

| **MOTOR PARAMETER** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S.No.** | **METHOD** | **Rs ohm** | **Rr ohm** | **Lls H** | **Llr H** | **Lm H** | **Pole** |
| 1 | ANFSI | 1.15 | 1.083 | 0.005974 | 0.005974 | 0.2037 | 4 |
| 2 | NNPIC | 1.405 | 1.395 | 0.005839 | 0.005839 | 0.1722 | 2 |
| 3 | Novel neural network | 1.77 | 0.0139 | 0.0121 | 12.1 | 0.3687 | 4 |

## CONCLUSION

In this paper induction motor have been analysed by PWM vector control method. In this paper provided suitable guide line improved Efficiency criteria of various level inverter with induction motor speed. The basic parameter like as speed enhancement vector control optimization approach. These are reduced circuit implantation and harmonic distortion of inverter circuit. Torque is also improving for multiple induction Motor.

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