ENHANCE METHOD A VECTOR CONTROLLED MACHINE DRIVE FOR MINIMIZATION OF ELECTRICAL LOSSES

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ABSTRACT.
The induction motor has in the industry. More attention has been a focus to develop and design of induction motor drives. With vector control, novelty proves the efficiency of induction motors over their entire speed range. In this paper, it is desirable to design a loss minimization controller that can improve efficiency. Also, this research described the Modeling of an induction motor with core loss included. Realization of methods vector control for an induction motor drive with loss element had—the case of the loss minimization condition. The procedure was successful in calculating the gains of a PI controller. Though the problem of obtaining a robust and sensorless induction motor drive is by no means completely solved, the results obtained as part of this work point in a promising direction.
Keywords: *Induction Motor, novelty method, vector control*

INTRODUCTION.

IM are critical components in industrial processes. A motor failure may yield an unexpected interruption at the industrial plant, with consequences in costs, product quality, commonly used in adjustable speed drive systems. Induction motors have been widely employed in various industries as actuators or drivers to produce mechanical motions and forces. Since it is estimated that more than 50% of the world's electric energy is generated and consumed by electric machines, improving the efficiency of electric drives is important [1.2]. Induction motors require a total operating range of speed and fast torque response in operational conditions, regardless of load variations. Namely, induction motors have high efficiency at rated speed and torque.
Its efficient control requires a suitable model with accurate parameters, the minimization of the objective function is carried out using the Particle Swarm Optimization. Particle Swarm Optimization (PSO) is an evolutionary algorithm inspired by social interaction. PSO is an evolutionary once technique (a search method based on a natural system) developed by Kennedy and Eberhart.

The basic concept of the PSO technique 'lies in accelerating each particle towards its p best and g best locations, with a random weighted acceleration at each time step. PSO has many parameters, and these are described as follows: V max is the maximum allowable velocity of the particles (i.e., in the case where the rate of the particle exceeds Vmax, then it is limited to Vmax). Particle swarm optimization (PSO) is one of the modern heuristic algorithms [16], [17]. PSO has attracted significant attention due to its features of easy implementation, robustness to control parameters, and computation efficiency compared with other existing heuristic algorithms and has been successful. Particle swarm optimization (PSO) is an evolutionary computation technique the system initially has a population of random solutions. Each potential solution called an electromagnetic torque is given by a particle. In this research paper, a new minimum-time minimum-loss control algorithm for induction motors using system particle swarm optimization is suggested to obtain high performance and high efficiency under practical constraints on voltage and current. The validity of the proposed scheme, which carries out minimum-time speed control in the transient state and minimum-loss supervision in the steady-state, will be revealed via simulation, including an induction motor model.

2. INDUCTION MOTOR LOSS MODEL

This paper described an equivalent circuit which points out the rotor magnetic current is used. An iron loss resistance Rf was added in parallel with magnetic inductance in the rotor flux reference frame which is shown in figure.1 [2,5,7]. Information related to this machine is presented in Appendix

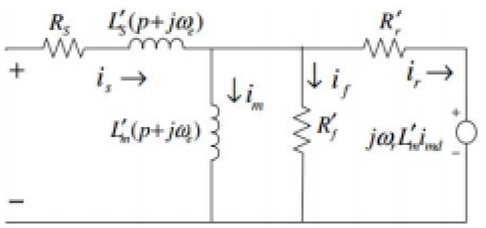

Fig 1. Equivalent circuit of induction motor containing iron loss resistance.

In permanent state, there is no leakage inductance on the motor and the equivalent circuit will be the same as fig.2.

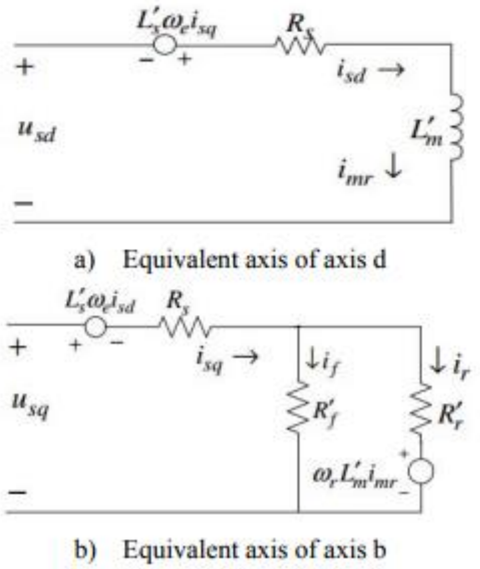

Fig 2. Motor equivalent circuit in the permanent state.

To develop the loss model, a typical simple approach has been discussed in the previous kinds of literature[1,2,5].Copper loss of stator, copper loss of rotor and iron loss which are stated as equation 1:

$$v_{f,g}^{(t+1)} = w \cdot v_j^{(t)} + c_1^* \mathrm{rand}()^* (\mathrm{pbest}_{j,g} - k_{j,g}^{(t)}) + c_2^* \mathrm{Rand}()^* (\mathrm{gbest}_g - k_{j,g}^{(t)}),$$

$$j = 1, 2, \ldots, n, \quad g = 1, 2, \ldots, m.$$

$$k_{j,g}^{(t+1)} = k_{j,g}^{(t)} + v_{j,g}^{(t+1)}, \quad k_g^{\min} \le k_{j,g}^{(t+1)} \le k_g^{\max}$$

3. PARAMETER PSO IN INDUCTION MOTOR

We think that a magnetic flux axis d is set up on the magnetic flux electric current vector as shown in figure 1. In the induction motor vector control, the voltage and ampere equations on the d-q axes are following.

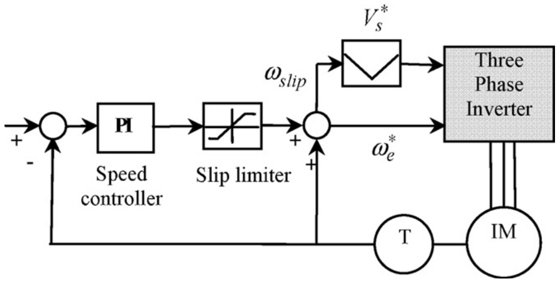

Figure3. Electric Current Vector

Voltage equation:

$$\begin{bmatrix} v_{sd} \\ v_{sq} \end{bmatrix} = R_s \begin{bmatrix} i_{sd} \\ i_{sq} \end{bmatrix} + \omega_1 \begin{bmatrix} 0 & -Lom \\ Lom & 0 \end{bmatrix} \begin{bmatrix} i_{sd} \\ i_{sq} \end{bmatrix} + Lom \frac{d}{dt} \begin{bmatrix} i_{sd} \\ i_{sq} \end{bmatrix}$$
$$+ \frac{M^2}{L_R'} R_R' \begin{bmatrix} i_{sd} \\ i_{sq} \end{bmatrix} + \frac{M^2}{L_R'} \begin{bmatrix} -\frac{R_R'}{L_R'} & -\omega_R \\ \omega_R & -\frac{R_R'}{L_R'} \end{bmatrix} \begin{bmatrix} i_\mu \\ 0 \end{bmatrix}$$

Ampere equation:

$$\frac{d}{dt} I_\mu = -\frac{R_R'}{L_R'} I_\mu + \frac{R_R'}{L_R'} I_{sq}$$

$$\omega_1 - \omega_R = \frac{R_R'}{L_R'} \frac{I_{sq}}{I_\mu}$$

In this section, the procedure of PSO in online system parameter identification is described. Here, each particle represents all parameters of estimated model. The proposed algorithm sequentially gives data set by sampling periodically. While starting, in the first period, the best system parameter is found by minimizing the SSE introduced. Here, the simulation for next period does not begin until the fitness of global best becomes lower than a predefined threshold. After that, the estimated parameters will not be updated unless a change in the system parameters are detected. to detect any change. In system parameters, the global optimum in the later period is noticed as a sentry particle. In the beginning of each of the next periods, the sentry reevaluates its fitness and if the fitness changes significantly or it becomes bigger than a predefined threshold, the changes in parameters are confirmed. If no changes are detected, the algorithm leaves this period without changing the positions of particles. In contrast, when any change in parameters occurs, the sentry alerts the swarm to reset their best location memories and then the algorithm runs further to find the new optimum values. For this purpose, the fitness of global optimum particle and personal bests of all particles are evaporated at the rate of a big evaporation constant. As a result, other particles have a chance to find better solutions than those stored on their pervious global and personal memories. Moreover, the velocities of particles are increased to search in a bigger solution space for new best solution

The diagram block of the proposed optimized approach is shown in fig.4. Motor control method was based on rotor flux vector control method (FOC). In this structure, speed and electromagnetic torque of the motor are measured to obtain magnetic current, An FLC is the conversion of Linguistic expressions based on expert knowledge into the control strategy[9]. First , the speed error and its variation derivative are input as FLC variables. Then, FLC output variable is introduced as the reference value. then these numerical variables are converted into the Linguistic variables. Five fuzzy sets are seen in table.1 as NL(Negative large), NS(Negative small), Z(Zero), PS (Positive small) and PL(Positive large)[11-15]. Fuzzy control structure is defined as follow: 1 Five fuzzy sets for each input and output variable

2 Fuzzification by using continuous universe of discourse

3 Using mamdani performance (min)

4 Defuzzification by using centroid.

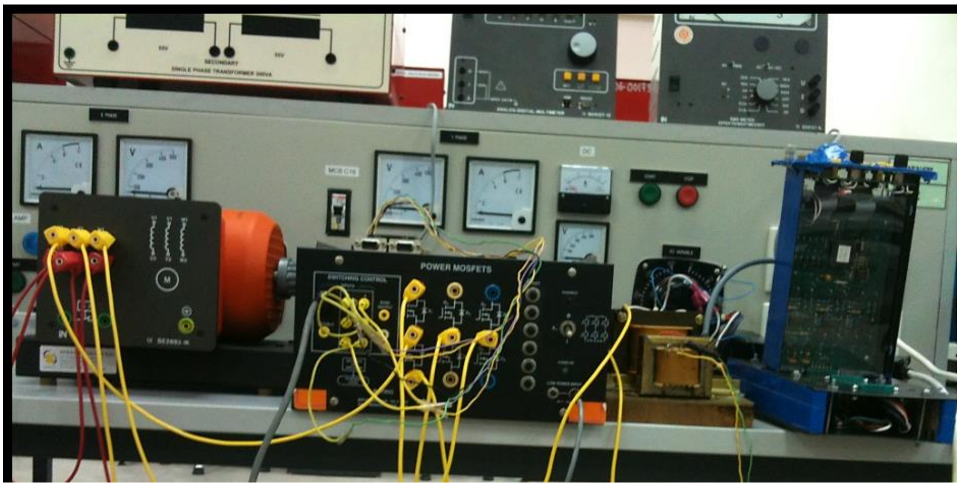

Fig 5. The physics Proposed Controlled

4. RESULT AND DISCUSSION

To certify both, steady state and transient behavior of the proposed algorithm some simulation has been carried out. The three phase induction motor has the following parameters: To know everything, I use a range Rr = 0.0025 ohms, Rs = 0.0015 ohms, f = 60Hz, P = 2, V= 120 V, for my induction motor.

A. Steady State

The steady state of stator flux and Electromagnetic

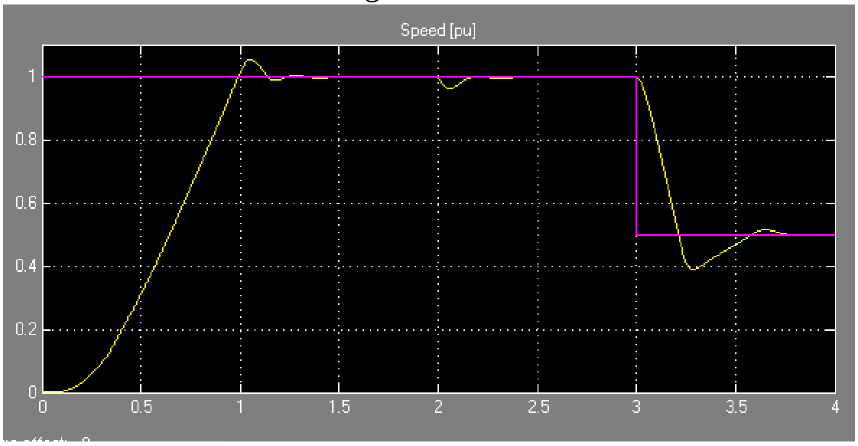

Figure4. Motor speed and reference speed during using HPSO

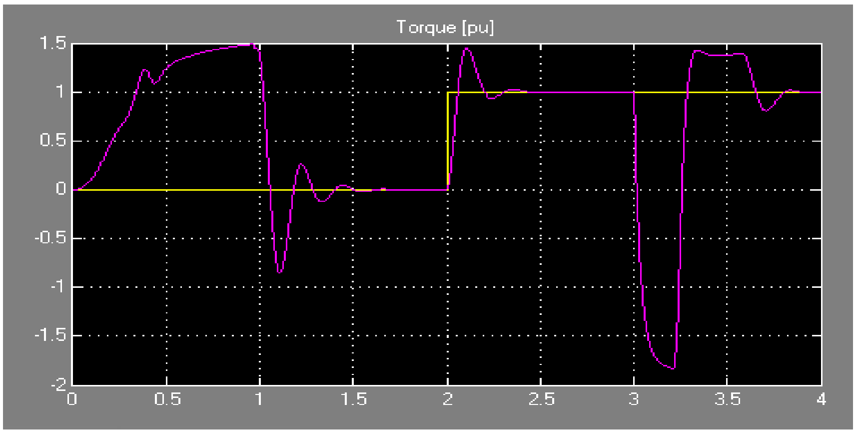

Figure5. Torque from Motor Induction Based HPSO

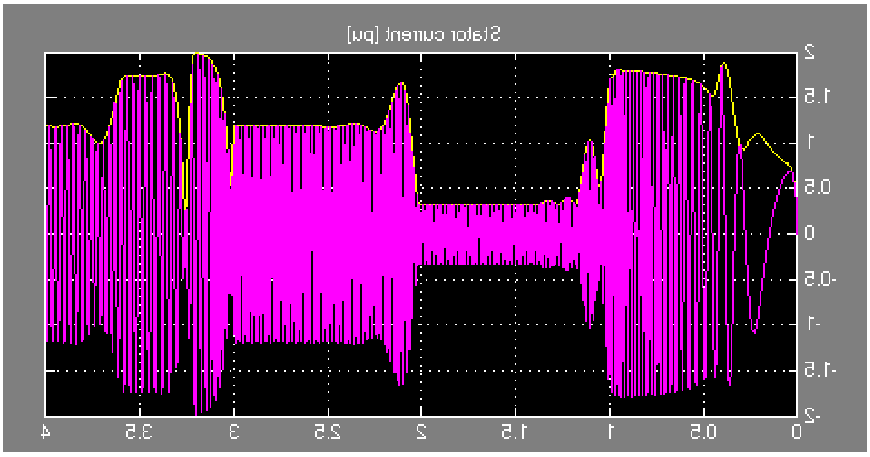

Figure6. Stator Current From HPSO Based Induction Motor

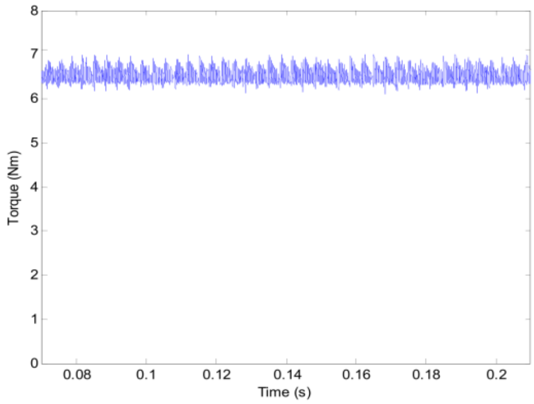

Figure7. Electromagnetic Torque

In the Figure 4, 5, 6, and 7, showed the speed, torque and stator currents of induction motors using system HPSO, where everything is quite stable when compared to using other systems.

5. CONCLUSION.

In this research, the system is presented to improve the Efficiency and decrease the losses. In order to increase the motor drive stability, during variations of speed and load, a fuzzy controller was used, which had higher results than a PI controller, the selected voltage vector in the new PSO schemes which produce the lowest start-up stator that may be current and torque ripple is reduced thereby increasing the performance of induction motor. Therefore, the tuning approach simultaneously evaluated in PI controller tuning speed and current PI controllers for vector control of induction motors in the simulation and experiment. Therefore, the following functions speed torque, speed, and efficiencies that can be jointly satisfied. HPSO induction motor model allows estimation of relevant parameters in motor speed, stator flux, rotor flux and torque without using sensors. This means that with a lower input power, the torque of input reference load has been supplied. When the load torque varies between 1 and 20 Nm, the input power using FG algorithm was reduced up to approximately 30%. On the other hand, the amount of loss with FG method had a significant advantage over the other two different torques.

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