A Novel and Performance Aware Approach for Induction Motor Parameter Recognition Using PSO

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ABSTRACT
The fastgrowing computational control of personal computers (PC) permitted researchers to device several optimizational algorithms and proves their efficiency. Many algorithmshave been established by researchers that mimic usual phenomena. (PSO) Particle Swarm Optimization is amongst these nature inspired algorithms.PSO optimization is applied to catch out the preeminent model parameter that reduces the sum square fault among the measured and the simulated flux. Simulation outcome prove the ability of the projected practice to capture the precise values of the machine parameter. In the paper PSO is implemented to get out five parameters (Armature Circuit Resistance, Armature Circuit Inductance, Moment of Inertia, Flux and Viscous damping coefficient) of the three stage induction motor.

Keywords: Wavelet Transform, Probabilistic Neural Network, Motor Current Signature Analysis, Particle Swarm Optimization

1. INTRODUCTION
For robustness, their simplicity and low cost the induction machines are generally used. Motor is a vital element in the industry. Lot of money and effort are required to repair or exchange a motor in case of motor damage. Studies have been conceded out about the letdown diagnosis of motors. Investigation has been made while long before to identify a mistake that happen in electrical machines [1]. We will consider the faults that are electric and mechanical; this kind of errors make known in the noise spectrum, which have precise frequencies. It is well-known fact that because of the motors’ faults induction motor dimensions will get change. That’s why these parameters have to be observed and, in mandate to avoid breakdowns [2]. Frequency component of the spectrum will modify when mechanical piece of the motor either wears or breaks up. In a revolving machine each
fault creates vibrations and noise with distinguishing features. To achieve the fault recognition and analysis these characteristics can be calculated and related with reference ones [2].

This paper treats bearing and gear failure. In the anomalous gearbox, a tooth of the in-between gear is broken [3]. By equating the statistics of the standard and unusual gear, the gear let down is executed [10]. And by comparing spectra for strong and fault rotor bars, bearing failure is executed [2].

Particle Swarm Optimization was encouraged by the talent of a group of birds or a school of fish to exploit on their collective information in discovery food or escaping predators. Every swarm fellow or particle has a minor memory that allows it to recall the best location it set up so far and its goodness. Particles are influenced by their personal knowledge (best found location) and their neighbors’ practices (best found location by the neighbors).

2. RELATED WORK
Leite, D. F et al. talks about an induction motor error discovery and analysis system. The scheme is built on monitoring of important electrical signals linked with an (EANN) evolutionary artificial neural network model. Stator windings interturn short-circuit have been effectively identified by the system. A real-encoding genetic algorithm has been recommended to develop architectures and weights of neural networks. M. Iorgulescu et al. noise of electric motors is examined in order to find information for the finding of faults. Huge clamor range contrasts between sound engine and engines with various flaws are watched. The flaws dissected are terrible bearing in the three stage acceptance engine and softened bars up single stage enlistment engine. The high-recurrence phantom examination of clamor gives a technique to distinguish faults. Khalaf Salloum Gaeid et al. detail or short winding and open winding are taken as a contextual investigation to demonstrate the viability of the wavelet
systems for blame diagnosis. Ravi C. Bhavsar et al. incorporates an exhaustive audit of various kinds of shortcomings happen in enlistment engine and furthermore call attention to the most recent patterns in condition checking technology. Khadim Moin Siddiqui et al. a far reaching study of enlistment machine issues, symptomatic strategies and future viewpoints in the wellbeing observing of acceptance engine has been discussed. Malik Abdulrazzaq Alsaedi et al. principle reason for this article is to update the primary choices in the identification of issues in enlistment machines and contrast their commitments concurring with the data they require for the analysis, the number and significance of the flaws that can be recognized, the speed to expect a blame and the precision in the determination. S. Karmakar et al. development of enlistment engine has been discussed. Then a survey of acceptance engine blame has been exhibited. Deficiencies like rotor broken bar, mass unbalance, detail or blames, single staging, creeping, bearing flaws, and so forth are talked about alongside circumstances and end results. K.C. Deekshit Kompella et al. presents a way to deal with distinguish the bearing issues experienced by acceptance machine utilizing engine current signature analysis (MCSA). The blame seriousness is evaluated by computing flaw ordering parameter of wavelet coefficients. K.C. Deekshit Kompella et al. Engine ebb and flow signature examination (MCSA) has turned out to be famous for identification and confinement of these flaws and has pulled in grouping of numerous specialists. In this detail or current is observed by methods for recurrence ghostly subtraction utilizing different wavelet changes to stifle predominant components. Pu Shi et al. The wavelet change (WT) procedure is incorporated with the neural system model to remove rotor blame highlights.

Firstly, the multi determination examination strategy of WT and the particle swarm
enhancement (PSO) hypothesis are utilized to separate the highlights of the misshaped flag. At that point, the probabilistic neural system (PNN) arranges these removed highlights to distinguish the rotor deserts compose. The proposed approach can lessen an incredible amount of the twisted flag highlights without losing its unique property.

3. PROPOSED WORK
A novel method for induction motor parameter recognition using PSO is implemented. Recognition of Parameter of the induction machine involves Armature Circuit Resistance, Armature Circuit Inductance, Moment of Inertia, Flux and Viscous damping coefficient. PSO based identification algorithm is used to get out appropriate parameter values that can minimize the integrated absolute error among the recorded waveform and that generated by a motor model using the identified parameters.

Table 3.1: Five Parameters to be identified

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ra</td>
<td>Armature Circuit Resistance [Ohm]</td>
</tr>
<tr>
<td>La</td>
<td>Armature Circuit Inductance [H]</td>
</tr>
<tr>
<td>Jz</td>
<td>Moment of inertia [kg*m^2]</td>
</tr>
<tr>
<td>psi</td>
<td>Flux</td>
</tr>
<tr>
<td>Ct</td>
<td>Viscous damping coefficient [Nm/rad/sec]</td>
</tr>
</tbody>
</table>

Fitness = ISE(flux)

Integral (of) Square(d) Error [performance index]

Flux = (Ua-Ra*I)/W

Ua: Rated Armature Voltage [V]

Ra: Armature Circuit Resistance [Ohm]

I: Rated Current [A]

W: Rated Speed [rad/sec]
4. RESULTS

Bearing Fault

Figure 4.1. Bearing Fault

Errors: 3.8242% -0.12472% 5.1067% 2.4261% 4.8178%
Figure 4.2: Estimated Parameters

Figure 4.3: Fitness Value
Abnormal Gear Teeth

![Graph](image1.png)

**Figure 4.4. Evaluation of Perspectives**

Errors: 0.30671% -0.17683% -1.3513% -0.67548% -1.3553%

![Graph](image2.png)

**Figure 4.5: Estimated Parameters**
5. CONCLUSION

The PSO algorithm is implemented to guess the real parameters of an induction motor which are given in Table 3.1. Fitness function Integral of Square (d) Error [flux], which estimates the fitness of the solution passed to it by solving the differential equations centered on the parameters of this solution using Matlab and gather the error which is the variance between the projected flux and the measured flux.

REFERENCES

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