International Journal of Engineering & Technology, 7 (2.13) (2018) 418-420

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Research Paper

An Effect Sensitivity Harmonics of Rotor Induction Motors Based On Fuzzy Logic

Solly **Aryza[1,2], Muhammad Irwanto[3], Wan Khairun Nizam[4], Zulkarnain Lubis[3], Maharani Putri[1], Andri Ramadhan[5], Fitria Nova Hulu[1], Pristisal Wibowo[1], Sari Novalianda[1], Robbi Rahim[6]**

[1,2]*Universitas Pembangunan Pancabudi, Medan, Gatot Indonesia,*
[2]*Student Post Graduate, Universiti Malaysia Perlis, Perlis, Malaysia*
[3]*Institut Teknologi Medan, Medan, Indonesia*
[4]*Universiti Malaysia Perlis, Perlis, Malaysia*
[5]*Universitas Al-Azhar Medan, Medan, Indonesia*
[6]*Sekolah Tinggi Ilmu Manajemen Sukma, Medan, Indonesia*
**Corresponding author E-mail: sollyaryzalubis@gmail.com*

Abstract

The stator is apart complicated because it is one of the main parts of mechanical components inside an induction motor and is often a heat problem in the electrical pressure and also due to competitive environmental conditions, etc. So this study discusses how the technique used in identifying the initial level of small error rate in the induction motor. Several studies also discuss motor vibration detection analysis. So this research is done about the harmonization of rotation causing this vibration amplitude which causes problems of mechanical stress and motor. So that the results of this research can be a result of learning about the effect of error amplitude, causing problems in the rotor and fuzzy logic results performed also resulted in increased amplitude of vibration in rotor harmonics

Keywords: *A Stator, Harmonics, Intelligent System*

1. Introduction

An Induction motor detection and monitoring system is a dominant matter of importance in improving the quality of the induction motor component itself as well as in the stator and rotor, due to various mechanical, thermal, electrical[1]–[3] and environmental problems resulting in a change of the structure of the induction motor. The detection and monitoring system is critical regarding reviewing and determining the feasibility of the condition of an induction motor. Where in general an induction motor undergoes several electrical and mechanical problems where there is interference in the air-gap, the issue of rotation between the rotor and stator and some other items.

Where in this paper described one of the problems in the induction motor is in the stator and rotor. Use of induction motor detection and monitoring system as well as analysis in vibration, stress, flux analysis, etc. Very often used in diagnosing motor errors and severity estimation[4]. Analyzing measurement systems have been found so that it can be conclusively found some mechanical errors (such as bearing failure, imbalance, misalignment, etc.) in induction motors [5].

There are also some parts of bearing failure problems in the stator winding that will be observed on the induction motor. The introduction of stator problems may vary. By doing phase sequencing. So this study aims to understand the influence and harmonics that occur due to issues within the induction motor by using the fuzzy logic method. With several studies of abnormalities in stator windings, a slight voltage imbalance addresses these issues which in turn leads to changes in induction motor vibration. Harmonic is a negative impact arising from the application of technology. Harmonics are generated by non-linear loads. The nonlinear load is a load having non-sinusoidal waveform because it has been distorted by the harmonic current generated by various electronic equipment such as motor iduction, squirel cage, electric motors controlled by converter static and so forth. Non-linear loads connected to the utility cause an increase in harmonics of the electrical system that supplies. The large percentage of Total Harmonic Distortion (THD) of an electrical load or on a power distribution system can cause serious problems such as generating poor system power quality, low power factor, distorted voltage waveform, increased system power losses , more heating on the transformer, the use of electrical energy becomes inefficient, and can affect the performance of other equipment using the power source[6].

2. Literature Review

Power system components that can generate harmonic currents should be considered, with the aim to predict the problems caused by harmonics, so it can be anticipated the right way to suppress the presence of the harmonics, either by installing filters, or designing electrical equipment so that the impact of harmonics generated by the material is still below the specified standard [7].

The existence of harmonics on the motor will result in additional losses to the magnetic intake of the rotor. The loss of hysteresis and eddy current becomes increased due to the frequency of the

Copyright © 2018 Solly Aryza. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

harmonic voltage on the coil. Hysteresis loss will increase as frequency increases.
The harmonious effect that can occur in the transformer power system is the more heat that causes harmonic load current losses, which is probably due to harmonics between the transformer inductance, the system capacity, the mechanical pressure of winding insulation and lamination and vibration [8]. Harmonics can affect the work of the transformation in two ways namely because of harmonics of voltage and current harmonics; voltage harmonics causes additional losses of transformer iron core because of high harmonic frequency this is caused because the transformer requires a considerable magnetization power [9]. the influence of the conductor by using the cable used to transmit electrical current energy flowing on the conductor can cause loss what conductors, when current flowing current harmonic current cause increase in injuries because of the rise of rms current and generate heat at the heat conductor, will further reduce its conductivity which ultimately increases the damage of power and decreases the efficiency of the conductor [10].
In Capacitors are generally widely used in the capacitance industry on capacitors inversely with the frequency that causes flow harmonics more easily flow on the capacitor happen more burden that can damage the capacitor [11]. Another effect that occurs on the capacitor due to harmonics is the occurrence of resonance events harmonics [12].
A controlled rectifier is a nonlinear load that contributes a lot of harmonics to power lines. The controlled rectifier can be adjusted output voltage by changing the angle of ignition or trigger on the thyristor [13].
The number of harmonic sequences generated (n) by the rectifier load depends on the multiples of the fundamental frequency by the name of pulses from the rectifier, can be calculated using the equation below:

$$n = \frac{f_n}{f_1} k.p \pm 1$$

Where :
n = harmonic sequence generated.
k = multiples of frequency
base = 1, 2, 3, and so on.
p = number of pulses from the rectifier.

One method of harmonic calculation is to use. Total harmonic distortion is a measure of all harmonic components which distorts a signal waveform. This quantity is calculated in two ways: the total harmonic distortion is calculated as the sum of all the harmonic parts (except the fundamentals) (vectorically) divided by their fundamental value which is then represented as THD or TDD (Total Demand Distortion), where the denominator is not its underlying flow, but its total nominal current (In) (the amount of underlying flow and the amount of harmony).
To calculate the voltage. (THD - V)
Total Harmonic
Distortion (THD)

$$THDv = \frac{\frac{v}{n}2=\frac{v2}{n}}{V_n} \times 100\%$$

3. Research Methods

The method used in this research is doing Measurement and data retrieval done directly to the stator to get different values of problem case induction motor. Measurement using a measuring device called Fluke 435 Power Quality Analyzer, data communication from Fluke 435 Power Quality Analyzer to a computer has done through RS232 / USB converter. This data communication packet is displayed in list and graph form directly, and the data can be saved to the computer. Parameters that can be taken are voltage harmonic components, current harmonics components, active power factor power, reactive power and apparent power. From the measurements, the value of each order of harmonics and measured power, especially the reactive influence, then the result of the measurement is analyzed and adjusted with IEC61000-3-2 Standard and examined its change to power quality.

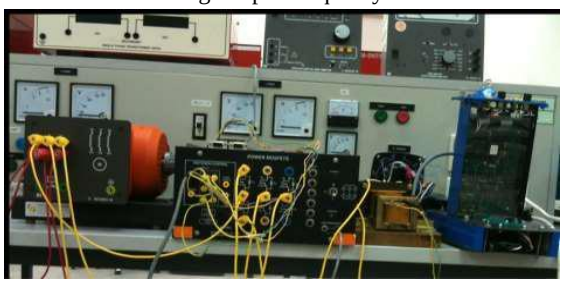


Fig 1: Experimental Set-Up

4. Results and Discussion

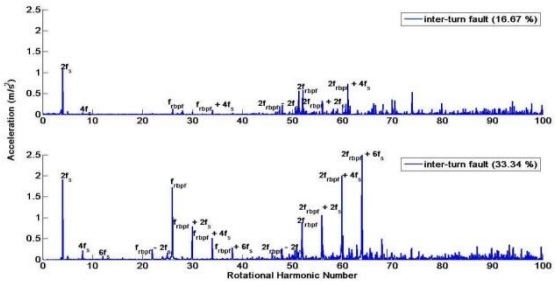


Fig.2: Residue order spectrum in vertical direction

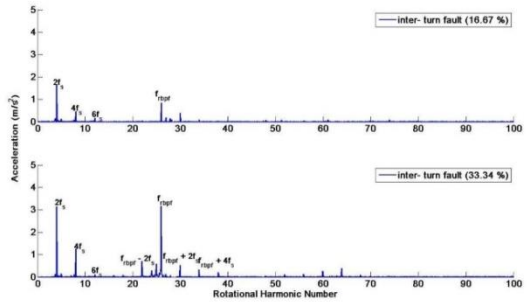


Fig.3: Residue order spectrum in axial direction

Harmonics produced by fuzzy logic method loads may cause induction interference on the load system , measurement error on the gauge, overheating of the power breaker, the control system is locked by itself the residue order spectrum from vibration analysis of the motor with respect to healthy state in vertical and axial direction under two inter-turn fault levels (i.e., 16.67% and 33.34%) respectively.
The higher harmonic frequency of the working frequency will result in a decrease in efficiency or a loss of power, which may result in excessive heat and vibration of the stator motor, resulting in more stress on the power system as a result of resonance between the capacitor with the system induction reactance and the harmonics may cause additional torque on an electromechanical type KWh meter using rotary induction disks. The average rise in vibration amplitude levels in a vertical and axial direction at two levels of inter-turn faults are represented in figure 2 and figure 3. Therefore, in addition to first harmonic amplitudes, these additional frequency features can also be considered for inter-turn fault detection in induction motor drives.

5. Conclusion

The last conclusion of this research, it is clear that inter-turn fault not only increases the vibration amplitudes of fundamental rotational harmonics but also affects rotor slot harmonic amplitude levels. Consideration of proposed additional features helps inaccurate diagnosis of the motor faults using vibration analysis where false interpretation may be possible in identifying exact nature of the failure that excited the amplitude levels when only fundamental harmonics are considered.

References

[1] R. Ratnadewi *et al.*, "Automatic Blood Pressure Detector Using Arduino to Measure Blood Pressure in Indonesian People Age 19-27 Years Old," *Int. J. Eng. Technol.*, vol. 7, no. 2.5, pp. 115–118, Mar. 2018.

[2] T. Listyorini and R. Rahim, "A prototype fire detection implemented using the Internet of Things and fuzzy logic," *World Trans. Eng. Technol. Educ.*, vol. 16, no. 1, pp. 42–46, 2018.

[3] C. Rahmawati, Z. Zainuddin, S. Is, and R. Rahim, "Comparison Between PCI and Box Girder in BridgesPrestressed Concrete Design," *J. Phys. Conf. Ser.*, vol. 1007, no. 1, p. 012065, Apr. 2018.

[4] S. Aryza, M. Irwanto, Z. Lubis, A. P. U. Siahaan, R. Rahim, and M. Furqan, "A Novelty Design of Minimization of Electrical Losses in A Vector Controlled Induction Machine Drive," in *IOP Conference Series: Materials Science and Engineering*, 2018, vol. 300, no. 1.

[5] I. Motor, F. E. Methods, B. R. Singla, S. Marwaha, and A. Marwaha, "Design and Transient Analysis of Cage Induction Motor Using Finite Element Methods," *2006 Int. Conf. Power Electron. Drives Energy Syst.*, 2006.

[6] S. Karmakar, S. Chattopadhyay, M. Mitra, and S. Sengupta, "Induction Motor and Faults," in *Induction Motor Fault Diagnosis Approach: through Current Signature Analysis*, 2016, pp. 7–28.

[7] A. M. Trzynadlowski, "4 - Power electronic converters for induction motor drives," in *Control of Induction Motors*, 2001, pp. 55–92.

[8] Y. H. Kee, I. Chaturvedi, C. K. J. Wang, and L. H. Chen, "The Power of Now: Brief Mindfulness Induction Led to Increased Randomness of Clicking Sequence," *Motor Control*, vol. 17, no. 3, pp. 238–255, 2013.

[9] M. A. Magzoub, N. B. Saad, and R. B. Ibrahim, "Efficiency Improvement of Induction Motor Variable Speed Drive Using a Hybrid Fuzzy-fuzzy Controller," in *Energy Procedia*, 2015, vol. 75, pp. 1529–1535.

[10] S. Aryza, M. Irwanto, Z. Lubis, A. Putera, and U. Siahaan, "A Novelty Stability Of Electrical System Single Machine Based Runge Kutta Orde 4 Method," *IOSR J. Electr. Electron. Eng. Ver. II*, vol. 12, no. 4, pp. 2278–1676, 2017.

[11] B. Mirafzal, G. L. Skibinski, R. M. Tallam, S. Member, G. L. Skibinski, and R. M. Tallam, "Universal Induction Motor Model," *IEEE Trans. Ind. Appl.*, vol. 45, no. 1, pp. 142–151, 2009.

[12] C. N. Jibhakate, A. Prof, and V. Huchche, "Speed Control of Single Phase Induction Motor Using Micro- Controller," *Speed Control Single Phase Induction Mot. Using TRIAC*, vol. 9359, no. April, pp. 29–32, 2014.

[13] A. I. Solly Aryza, Hermansyah, Muhammad Irwanto, Zulkarnain Lubis, "a Novelty of Quality Fertilizer Dryer Based on Solar Cell and Ann," *Scopus*, pp. 1–5, 2017.