IJAREEIE

e-ISSN: 2278-8875
p-ISSN: 2320-3765

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

Volume 10, Issue 7, July 2021

ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.282

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.282|

||Volume 10, Issue 7, July 2021||

|DOI:10.15662/IJAREEIE.2021.1007056 |

Detection of Rotor Broken Bar using Motor Current Signature Analysis

Vrushali Patil[1], Prof. Kinge A.P [2], Dr. Kanade S.G.[3]

Department of Electrical Engineering, BSCOER, Narhe, Pune, Maharashtra, India[1]

Department of Electrical Engineering, BSCOER, Narhe, Pune, Maharashtra, India [2]

Department of Electrical Engineering, BSCOER, Narhe, Pune, Maharashtra, India [3]

ABSTRACT: Maximum industries are acquitted with induction motors. So if there is failure of induction motor then it leads to sever loss if it's not detected within a time. To detect fault at initial or early stage can reduce motor from getting damage and also reduce maintenance and repair cost. So this proposed system detects faults at early stage and without interruption of motor's operation. So we save time and money by continuous monitoring current during healthy and unhealthy condition.

KEYWORDS: Faults in Induction Motors, Technique to Detect fault, Zero-setting Protection, MCSA.

I.INTRODUCTION

As Induction motors are having many advantages so about 90% of industries acquitted with it. As induction motor does not have brushes or slip rings, so maintenance requirement is not frequent than other motors like DC or synchronous motor.

As induction motor works in dusty environment while other motors required continuous cleaning for proper operation. Unlike synchronous motor it does not require any starting element, induction motor are self-started motors. The main advantage is that much industrial application requires different speed for different loads. Induction motors available with different speed and torque ratings. The speed of induction motor can be control easily so these motors are available widely in industry.

There are different types of faults which are occurred and causes damage to induction motor. We can categorise them as Electrical faults, Mechanical Faults and Environmental Faults. Electrical faults consists Under Voltage, over voltage, over Current faults, Single phasing faults, reverse phasing faults, inter-turn faults, earth faults. These are controlled by relays and circuit breakers. Mechanical faults consists damage across mechanical parts like rotor, end ring, shaft, bearing and stator part. Broken rotor bars are one of them. When one of the bars get break and which causes sudden rise in current this effects on adjacent bars to carry more current as well as its effects on stator windings which may leads to complete damage of induction motor.

Through this proposed system we can detect this severe fault at initial or early stage without interrupting motor's operation. This system is followed by zero setting analysis in which we are going to use Motor current signature analysis for detection of rotor broken bars. This system is cost effective.

II.RELATED WORK

In [1], authors describe a protection element that determines the number of broken bars using the relative magnitudes of the signals at the sideband frequencies ($\pm 2sf_o$) caused by the broken bars, with respect to the signal magnitude at the system frequency (f_o). This normalization allows the algorithm to identify rotor failures independent of motor characteristics.

In [2] authors describes mechanical faults and their causes with Fourier Transform and Wavelet transform techniques under motor current signature analysis

The Fast Fourier Transform (FFT) method is successfully used for the broken rotor bar fault detection purpose in the induction machines. It is based on the common-steady state analysis of the motor. This method is successfully used with Motor Current Signature Analysis (MCSA) technique for last three decades. However, this method is suffered

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.282|

||Volume 10, Issue 7, July 2021||

|DOI:10.15662/IJAREEIE.2021.1007056 |

from some serious drawbacks such as; it is applicable only in the constant load condition not for the variable load. The frequency-domain methods which are commonly used need accurate slip estimation for frequency components localization in any spectrum. It is also not suitable at the no-load or light load condition of the motor. At light load condition, it is quite difficult to distinguish between healthy and faulty rotors because the characteristic of broken rotor bar fault frequencies are very close to fundamental component and their amplitude are small in comparison [3].

In [6] authors describe, In generally, detection and diagnosis of incipient faults is desirable for product quality assurance and improved operational efficiency of induction motors running off the power supply mains. In this paper,the vibration and current of an induction motor are analysed in order to obtain information for the detection of bearing faults. Significant vibration and current spectrum differences between healthy motor and motors with fault bearing are observed. The high frequency spectral analysis of vibration and current provides a method to detect bearingfaults.

III.PROPOSED SYSTEM

A. Design Consideration:

The Motor current signature analysis is wider field of Electrical Signature Analysis as it consist Current signature analysis, voltage signature analysis, extended park's vector approach, instantaneous power signature analysis. It also includes Motor circuit analysis.

This current Signature Analysis is used to analyse and monitor the system. In this system we are going to analyse and monitor stator current of the motor. In figure 1 Stator current monitoring system MCSA is monitoring stator current of the motor.

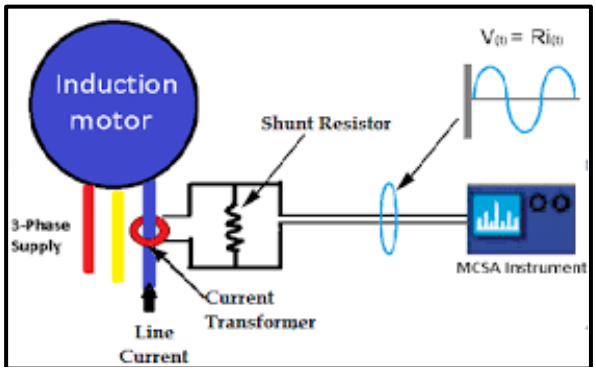


Fig. 1Motor Current Signature Analysis

The Motor current is measured with the help of current transformer and this current will be recorded in time domain. This measured current signal is given to the spectrum analyser and in ideal condition motor current should be sinusoidal wave but in reality it consist many harmonics. Through this we can compare the healthy current with the unhealthy current.

This proposed system will work on many faults, the faults are static or dynamic air-gap irregularities, broken rotor bar or cracked rotor end ring, stator faults. But in this system we are going to focus on broken rotor bar. These faults are occurred due to various reasons like direct online starting duty cycles and pulsating machine loads. The broken bars can cause overheating or sparking. Through this we are going to examine frequency spectrum of stator current by which we can find rotor broken bar failure.

For this we are going to use Fourier transform and wavelet Transform. The Fourier Transform records current in time domain. After conversion is performed then for analysing we are going to use Fourier transform and through this we analyse signal in frequency domain. The basic disadvantage of FFT is it provides frequency resolution but it lacks in time resolution. But the Wavelet transform enables analysis in the time-frequency or the time-scale domain.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.282|

||Volume 10, Issue 7, July 2021||

|DOI:10.15662/IJAREEIE.2021.1007056 |

The fig. 2 shows the diagram of proposed system by which we are going to analyse current and provide protection to motor at early stage.

In this system we will have to measure current. The current of motor will be monitored through current transformer. Current should be effectively monitored to achieve improved condition monitoring and protection system for induction motor. Signal conditioning circuit will be used to measure current at microcontroller end. Signal conditioning is needed to make the current signal compatible to microcontroller to read. Current will be measured through internal ADC of microcontroller. The current data in the form of digital signal will be transmitted to PC end through serial communication circuit and USB to serial converter. At the PC end, current data will be processed through various blocks wavelet transform of the data will be taken. Also, healthy waveforms will be stored in database. We will have to continuously compare current with the stored values so that if there will be any fault we can detect it at early stage and also without interrupting motor's operation.

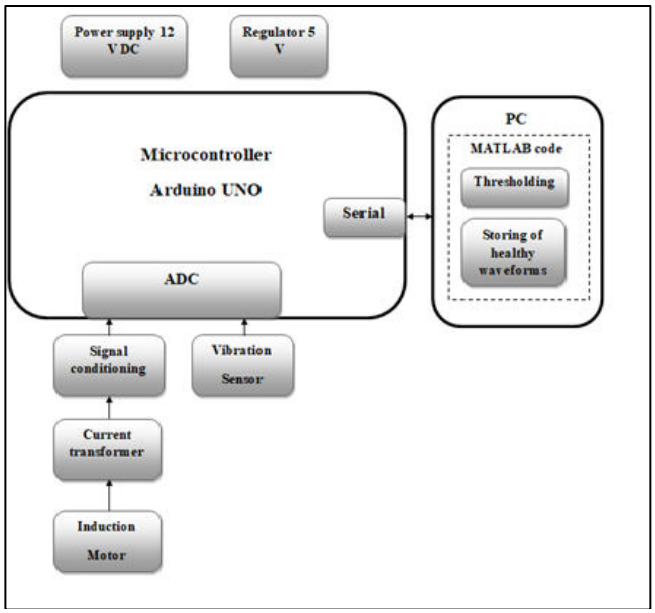


Fig. 2 Proposed System

IV.PROCESS OF FAULTMONITORING

Flow of fault monitoring is explained below:

- Through Sampler we samples current signal and remove undesired high frequency components and the signal is converted into digital form using analog to digital converter A/D.
- By using processor we are going to Convert sample signal from time domain to frequency domain using fast Fourier transform and Wavelet transform
- At fault detection stage, algorithm keeps only those components which specify characteristic frequencies of the current spectrum.
- After fault detection stage we are going to diagnoses the frequency components found in above stage and classifies the frequency components which consider as post processor stage.

| e-ISSN: 2278 – 8875, p-ISSN: 2320 – 3765| www.ijareeie.com | Impact Factor: 7.282|

||Volume 10, Issue 7, July 2021||

|DOI:10.15662/IJAREEIE.2021.1007056 |

V.CONCLUSION

Through this proposed system we can diagnose many faults at initial stage without interrupting motors operation. Through this we can avoid severe damage due to the broken rotor bar fault and it is economical so we can implement it easily.

REFERENCES

[1]. Carlos Pezzani, Pablo Donolo, Guillermo Bossio, Marcos Donolo, Armando Guzmán, Stanley E. Zocholl,"Detecting Broken Rotor Bars With Zero-Setting Protection", IEEE Transactions on Industry Applications, Volume: 50, Issue: 2, March-April 2014

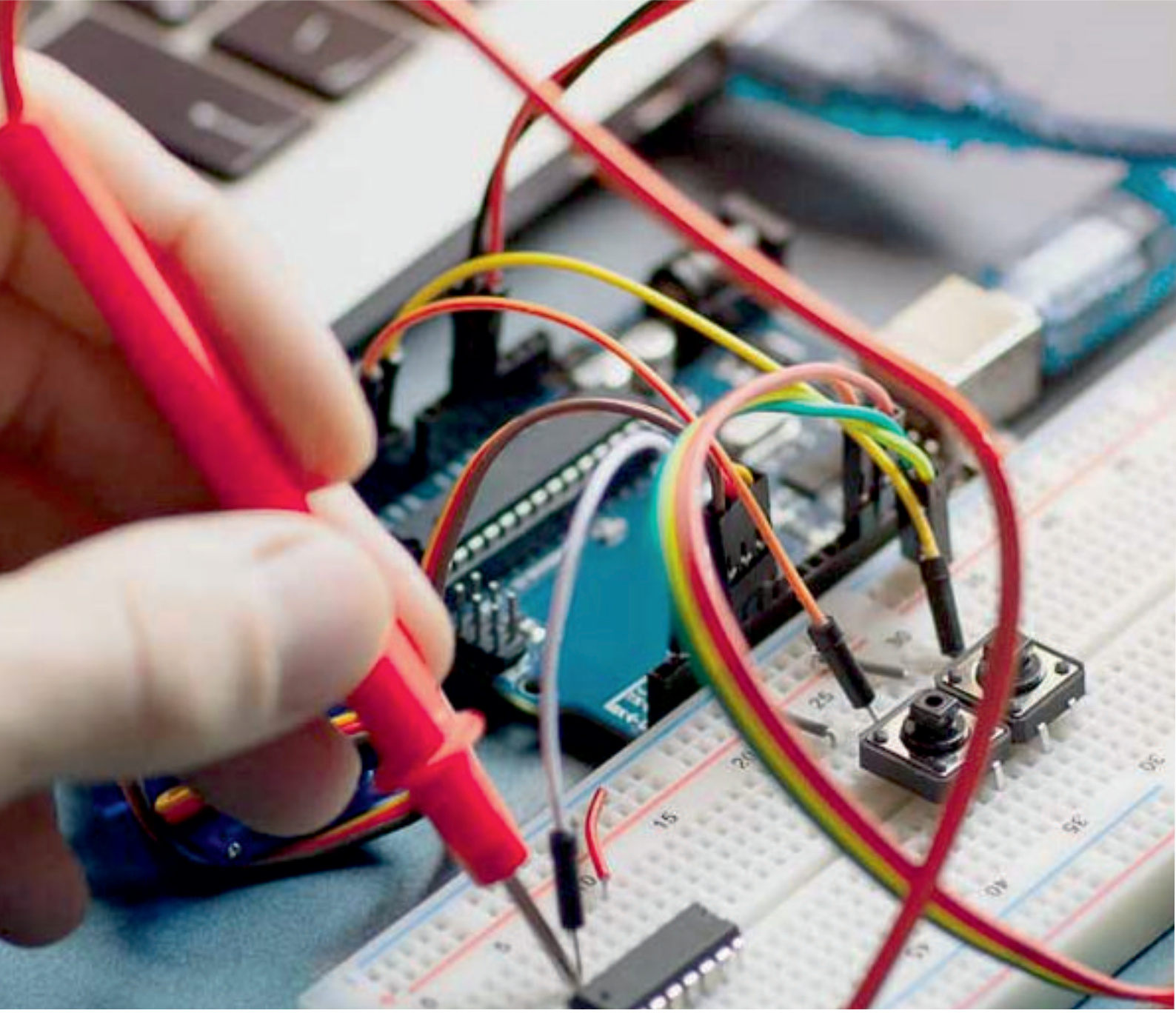
[2]. Dubravko, MILJKOVIĆ, HEP, Zagreb, CROATIA, "BRIEF REVIEW OF MOTOR CURRENT SIGNATURE ANALYSIS", HDKBR INFO Magazine, Vol. 5 No. 1, 2015.

[3]. Khadi moin Siddiqui, V.K. Giri, "Broken Rotor Bar Fault Detection in Induction Motors Using Wavelet Transform", International Conference on Computing, Electronics and Electrical Technologies [ICCEET], March 2012

[4]. Tristan Plante, Ashkan Nejadpak, and Cai Xia Yang, "Faults Detection and Failures Prediction Using Vibration Analysis", IEEE AUTOTESTCON,December 2015

[5]. William T. Thomson, Ronald J. Gilmore., "Motor current signature analysis to detect faults in induction motor drives-fundamentals, data interpretation and industrial case histories", Texas A&M University. Turbomachinery Laboratories, 2003

[6]. Mariana IORGULESCU, Robert BELOIU, "Vibration and Current Monitoring for Fault's Diagnosis of Induction Motors", Journal of Measurements in Engineering, Vol. 2, Issue 4, 2014, p. 190-198, 31 December 2014.



INNO SPACE
SJIF Scientific Journal Impact Factor

Impact Factor: 7.282

doi cross ref

ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर NISCAIR

International Journal of Advanced Research

in Electrical, Electronics and Instrumentation Engineering

9940 572 462 6381 907 438 ijareeie@gmail.com

www.ijareeie.com

Scan to save the contact details