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FORTIFICATION AND CULPABILITY ANALYSIS OF THREE PHASE INDUCTION MOTOR USING LABVIEW

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ABSTRACT

This paper directed on both defense, liability analysis of three phase induction motor. The electrical quantity of the motor is incessantly monitored by statistics acquirement Cards. If the motor meets the current more than it's rated or predefined value, the motor is tripped off from the supply and it is watched over from the smash up. This course of action is achieved with help of the relays. Machine winding reimbursement is encountered with the help of lissajous method. The frequency of apiece phase is endlessly monitored and the assessment is done with one another. These progression can be achieved by the internal process of the Lab VIEW software and the consequence is displayed with the facilitate of CRO.

KEYWORDS: Three Phase Induction Motor, Stator Winding Fault, Protection, Relay Lissajous Technique, Lab VIEW, Data Acquisition System, CRO

INTRODUCTION

Induction motor is the backbone of industries but these type of motor is get damaged either overload conditions or some other reasons. So this paper had great contribution with those problems. The motor is first checked whether the machine windings are in good conditions or not. After that the machine allowed to the load. Rotor current of the induction motor is directly proportional to the applied load.

The load current is continuously monitored by the Data Acquisition systems of lab VIEW. If the measured value of current is high compared to the motor rating, the machine is separated from the supply with the help of relay circuit. The main reason to introducing this protection system is the starter of an induction motor have not any overload relays as like Direct current motors.

Progression of Caring the Induction Motor with Lab VIEW

The three phase induction motor are normally started with help of star-delta, DOL starter, etc. These starters haven't any protection circuit to protect the induction motor from over load conditions. So, this paper introduced the technique for the protection of induction motor with help of lab VIEW. Stator current and voltage are continuously monitored and the values are displayed in the computer.

Consider the three phase induction motor ratings are followed by, 5HP, 410V, 7.5A, 1500rpm. The motor is allowed to the load condition. If the load applied on the motor may be beyond its rated value means the motor is tripped off from the supply. This process can be achieved by the following algorithm.

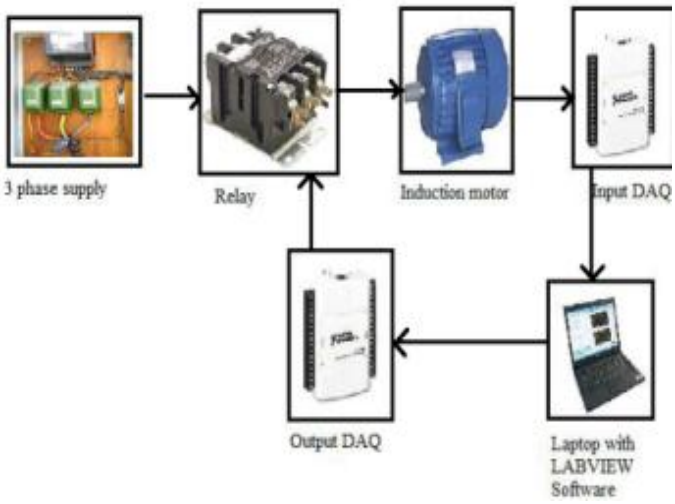

Figure 1: Experimental Setup for the Fortification of Induction Motor

The above figure1 shows that, the three phase induction motor is connected to the supply through relays. The voltage and current present in the stator winding of the induction motor is continuously monitored by the DAQ. For the measurement of voltage and current the separate DAQ's are used in the labVIEW.NI-9225, NI-9227 are the USB type DAQ's which are directly connected to the laptop or personal computers.

There is no need of any conversion before sending in to the system. Threshold values are set by the user or operator in the computer. So that the measured quantities are continuously compared with the threshold values. According to the comparison the control signals also produced in the system. Generated control signal is drives the relay then the motor is separated from the supply. The transmission control signal from laptop or personal computer is achieved by using the NI-9476. It's a digital input and output DAQ. But the NI-9225, NI-9227 are the analog input DAQ. The temperature also can be measured by the thermocouple module and these value also feed into the laptop. The temperature measurement is done with the help of NI-9211.

Surveillance for the Defense of an Induction Motor

The front panel of the lab VIEW shows the status of the induction motor. There are many cases which is displayed using the indicator the LED's. The control signal is send to the relay driving DAQ (i.e.) NI-9476 for all the three cases

- Temperature rising
- Current rising
- Both temperature and current

Functioning of the Sytem for the Period of Normal Operation of the Induction Motor

The figure shows the normal condition of induction motor. All the LED's are in OFF condition it resembles that the motor working under the normal condition.

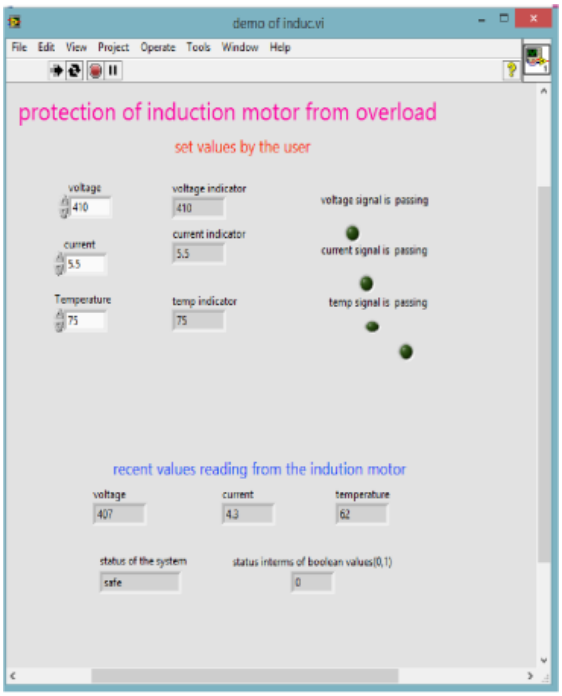

Figure 2: Front Panel of the Lab VIEW Software during the Normal Operation of Induction Motor

There four LED's persent in the pront panel of the lab VIEW software.

- First LED is used to indicate the exceeding of voltage.In general the voltage at the motor is normally constant. So it is rare case.
- Second LED is used to indicate the exceeding current.
- Third LED is used to indicate temperatue rising.
- Fourth LED will glow, for the above three conditions. Because its output is obtained by performing OR operation with above three conditons.

System Output during the Over Loaded Condition of the Induction Motor

The front panel of the current exceeding indication LED is glowing in the figure 3. So from this observation we can understood that the motor running under the abnormal condition. (i.e.) the measured value is exceeding the threshold value.

- The measured current value is high when compared to its threshold value.
- So the control singnal passed to the relay driving DAQ.

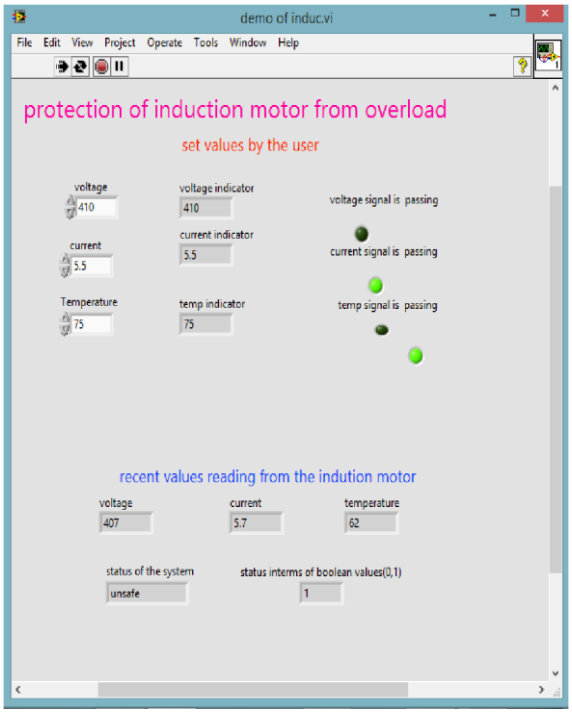

Figure 3: Front Panel of the Lab VIEW Softwre during the Current Exceeding Condition of an Induction Motor

Reaction of the Intended System during the Temperature Rising in Induction Motor

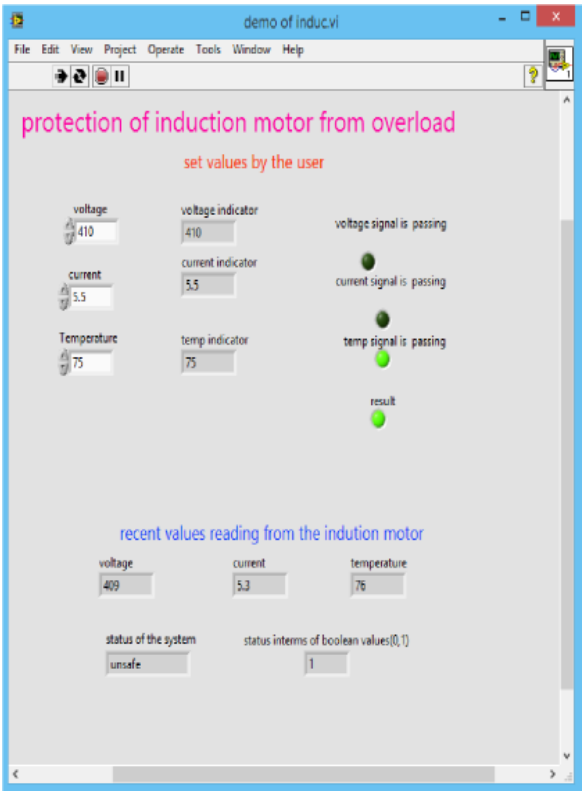

Figure 4: Front Panel of the Lab VIEW Software during the Temperature Rising in Induction Motor

In figure 4 the temperature rising LED is glowing so that we can understood that measured temperature from the induction motor is high when comparing with the threshold value of the temperature which is set by operator or user.

Guilt Analysis of Three Phase Induction Motor

The stator winding faults in three phase induction motor are,

- Symmetrical fault or three phase fault
- Asymmetrical fault
  - Line to ground
  - Line to line
  - Double line to ground

The few faults are shown in the figure 5

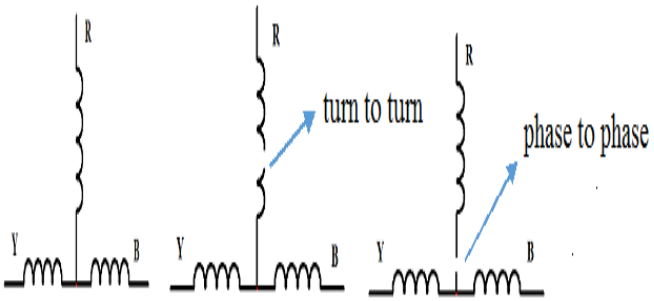

Figure 5: Few Faults in Induction Motor

There are many techniques are available for the fault detection of induction motor. But in this paper the fault detection is encountered using the lissajous technique.

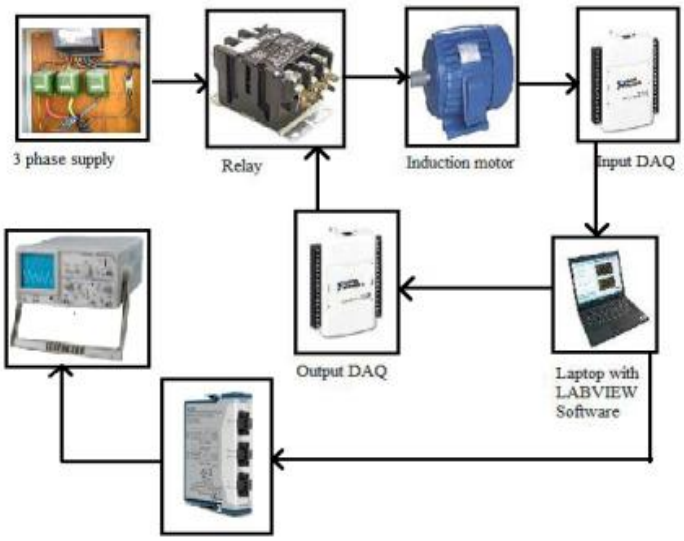

Figure 6: Experimental Setup for the Detection of Fault in the Stator Winding of an Induction Motor

The frequency of the each phase is compared with one another, if the phases are having the same frequency means the circle is formed in the CRO. The value are cannot taken into the CRO directly. The each phase of the current is measured using the NI-9227 and the out are send into the CRO using NI-ElVIS-II^{+} board. It is also one type of interfacing device between the lab VIEW software and external peripherals such as CRO etc.

The Practice Used on Behalf of the Revealing of Faults in Induction Motor

Lissagious technique is used for the detection of faults in stator windings.This method is processed by using the CRO. The singnal are feed into the CRO through its channels. After that the X-Y button is pressed in the CRO. If the two signals are having same frequency means the circle is formed.

The lissajous technique is eplained using the figure 6.

In this following figure there are two signals are feed into CRO as consideration. The output in the CRO will be as follows.

The unknown frequency in lissajous pattern is measured using the following technique,

F_h = frequency of the signal which is applied to the horizontal palte (known)

$F_{v=}$ = frequency of the signal which is applied to the vertical palte (unknown)

Consider the figure 6, the horizontal tangencies is two and verticle is one. So that,

$2F_{h=}F_v$

From the following equation,The frequency of the unkown signal is equal to the half of the known frequency.

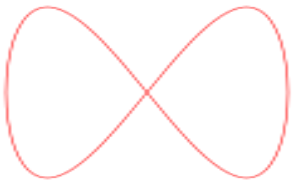

Figure 7: Lissajous Pattern

Here the the two signals are considered as sine and cosine waves. But it having a same frequency so that the circle is formed in the figure 8.

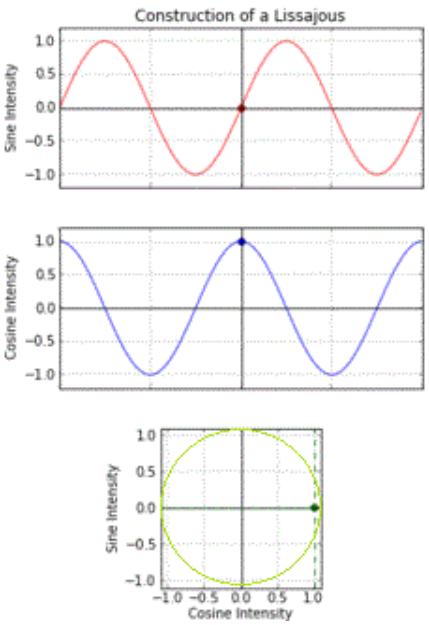

Figure 8: Lissajous Technique Output under the Singnals Having Same Frequency

Apparatus Used in the Fault Detecting System

The same experimental setup (figure 1) is used for the fault detection technique also but in addition to that one CRO is used here.

The each phase current is measured using the NI-9227 DAQ and the lissajous technique is applied on the phase currents of the frequency. If the circle is formed than the motor is free from the stator winding faults.

If its not then some calculattions are performed inside labVIEW software the type of faults is detected by the designed system and it's displayed in the front panel of the labVIEW software. The signal is feed to the CRO using NI-USB 6255. It's a analog output device.

Response of the CRO with Faulted Induction Motor

The analog output of the NI-6225 is acquired in the ELVIS II^+ board and it is feed into the CRO with the help of Probes. The machine having the faults so the CRO output will not be a circle. it is displayed in the figure 9.

Figure 9: CRO's Output with Faulted Windings

The Induction Motor without Winding Fault

In this case the winding of a three induction motor havent any faults. The analog output of the NI-6225 is acquired in the ELVIS II^+ board and it is feed into the CRO with the help of Probes. So the frequency of the each phase will be same and the circle is formed in the CRO (i.e.) figure 10.

Figure 10: CRO's Output with Non-Faulted Windings

CONCLUSIONS

This paper having a new technique for the detection stator winding faults and gives a methodalogy to protect the induction motor from over load conditions. The lissajous technique will be a easiest technique for the detection of stator winding faults. This paper will make a userfriendly plotform for the operator or user of the induction motors. The protection methodology having a more flexiblity and it can be used for any rating of the motors.

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