IMPLEMENTATION AND IDENTIFICATION OF BERING FAULT IN HILBERT TRANSFORM DEMODULATION BY USING A THREE PHASE INDUCTION MOTOR

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ABSTRACT
Health monitoring using antifriction bearings may be challenging, especially in the early stages of an illness. Inattention to bearing issues might result in equipment failure. The most frequent causes of rolling element bearing issues are faulty design or fabrication, installation, misaligned bearing races, and uneven rolling element diameters. Failures of rolling element bearings can also result from overloading and fatigue. In this post, we'll go through all of the many techniques for identifying rolling bearing issues. There are four unique approaches to identify and diagnose bearing problems, according to research. Acoustic and temperature data are also accessible in addition to vibration data. Because of its ease of usage, it is the most popular strategy.Vibration, acoustic measurements, temperature readings, and wear debris analysis are all linked to bearing defects.

INTRODUCTION
The use of equipment condition monitoring and fault detection in the industrial sector has greatly increased recently. Long-term, preventative maintenance might end up saving a business millions of dollars. As it frequently wears down and is typically the main reason for system failure, rotating equipment depends significantly on this component. Certain machine components must function properly to prevent costly long-term downtimes. A wide range of enterprises may benefit from employing equipment condition monitoring systems to prevent performance degradation, malfunctions, and even catastrophic failures [1]. A person's life is in risk, hence the bearings need to be fixed. This was, without a doubt, the situation. In order to monitor bearing health effectively and efficiently, cutting-edge equipment is required. [2]
Sliding bearings and rolling bearings are the two most common kinds. Linear and journal bearings are the most popular types of sliding bearings. A common kind of rolling bearing is a ball or roller bearing. In a variety of machines, rotating shafts may be moved by using rolling element bearings, which can be found in a variety of things such roller skates and roller cycles as well as aviation gas turbine and rolling mill applications [3]. Rolling bearings providea lot of benefits over other kinds of bearings.
Low lubrication needs make them often referred to as"antifriction bearings" [1]. For high-speed shaftspeeds that need long-term durability and low frictionoperation, roller bearings are the bearings of choice. As illustrated in the figure 1, bearings are made up of a number of components, including the outer race andinner race, rolling elements that are in contact under high dynamic loads and fairly high speeds; and optionally a cage around these rolling elements The issue of rolling element bearings is extensively covered in [4-6].. In certain places, single-point problems like chipping and dents are the most common occurrences. A high-frequency resonance may be formed when these imperfections come into contact with other parts of the bearing. Damage to a rolling bearing might result in the bearing's complete failure or a severe reduction in its performance.
Bearing arrangements can only function successfully if the operating and ambient circumstances are perfectly suited to the features of the bearingarrangement. When a bearing fails, it's not usually because of the bearing itself. [8] Deficiencies in materials or workmanship are very rare causes ofinjury or death. Improved bearing designs in the industrial sector are now possible thanks to new methods and techniques. In contrast, the more bearings there are in a process, the more probable it isthat it will go wrong. CAE-based simulation models, experimental models, and mathematical models are all being used. This study's primary goal is to provide a

complete review of the most recent bearing defect assessment techniques. Investigation has led to the discovery of four distinct ways for recognizing and diagnosing bearing issues. In addition to vibration, acoustic and thermal data are also available.

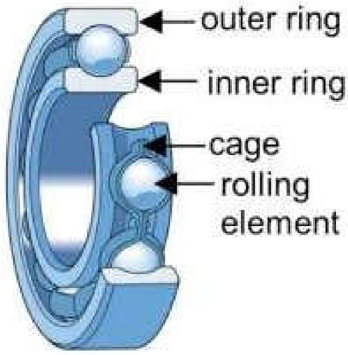


Fig. 1 Main components of the rolling bearing(SKF)

PROJECT OVERVIEW:

Power electronic-based technology has had a significant impact in both the industrial and residential sectors. These devices have a substantial impact on the quality of the supply voltage by increasing the harmonic current. At the same time they have a negative impact on overhead andunderground losses; spinning electric machines; transformers; protection system functioning;excessive voltages; measurement inaccuracies; andfailure of low-efficiency customer-sensitive loads.

Our idea uses shunt-hybrid power filters to enhance power quality. Reduced transformer losses and distortions have made it feasible to achieve higher power outputs by using the full voltage and current potential of the source. There are no limits to the quantity of power that can be handled by this transformer. A reduction in lower order harmonics is necessary to get the optimum outcomes.

POWER QUALITIES IN POWERDISTRIBUTION SYSTEMS

Standards describe "power quality" in terms of the physical qualities of electricity provided under normal circumstances that do not interfere with or disturb the customer's activities. Customers' equipment may be affected by any voltage, current, or frequency fluctuation that results in a malfunction or a worse quality of service. If you want a power supply that is trustworthy, you need to go beyond voltage and supply reliability.

Supply reliability is determined by three factors: enough serve (ability to supply the load), secure supply (ability to tolerate abrupt disruptions such system breakdowns), and conveniently accessible supply (focusing especially on long interruptions).

An electrical supply's physical properties that don't interfere with regular operations are referred to as "power quality" by international standards. Customer equipment may malfunction or act erratically if voltage, current, or frequency anomalies are present in the power supply. Voltage purity and supply dependability are the two most critical aspects to consider when evaluating a power supply's quality. It is called a "voltage quality issue" when equipment fails owing to changes in line voltage from its nominal characteristics. Availability, security, and sufficiency are the three criteria that determine supply dependability (focusing especially on long interruptions).

Importance of power quality :

To gauge the quality of a power supply, there are several methods available. A sinusoidal voltage waveform with both amplitude and frequency is the ideal electrical supply, however this is impossiblebecause of things like nonzero supply system impedance, variable loads, and other events like transients and outages. When the network's powerquality is excellent, all linked loads will function smoothly and efficiently. There will be no substantialcosts while the system is in place. Electrical installation efficiency can suffer if the network is of low quality. The system may not work at all, or it may cost a lot to install and run.

Cost of poor power quality:
It is defined as any event that affects the electrical system and causes financial losses. The followingthings may happen if the power is of poor quality: To add insult to injury, a malfunctioning power supply might result in computer and manufacturing line control systems being damaged, as well as increased system losses and utility penalties since the site is polluting its supply network (breakers tripping).

Harmonic Distortion:
Total Harmonic Distortion, or THD, is a measure of harmonic pollution that is defined as the ratio of RMS harmonic content to the fundamental. When the frequency of one signal or wave is an integral (wholenumber) multiple of the frequency of another, that signal or wave is said to be harmonic. Such a signal or wave's frequency may alternatively be expressed as a ratio of its own amplitude to the amplitude of the reference signal.

Effects of harmonics:
The grid is impacted by voltage and current harmonics in the following ways: Resonance in series and parallel causes an increase in harmonic values. greater use and transmission losses result in lower overall efficiency. decomposition of electrical plant components as a result of their age Failures in the manufacturing process; electrical equipment faults;Overheating and ultimately motor breakdown; Capacitors used to modify the power factor have failed due to overloading, overheating, and failure. Harmonics and capacitors work together to produce aresonant sound. The grid was shut down because to overheating neutral wires and transformers. Using metering equipment results in a high rate of measurement mistakes. Faulty devices including fuses, circuit breakers, and more Data may be lost if the computer's voltage fluctuates. Flickering may be seen in the video. Electromagnetic interference damages backup generators and related AVR control technology, stopping them and causing damage tothem and other communication systems. The Ripple control system is harmed as a result of this issue.

Harmonic sources:
Harmonics in voltage and current are most often caused by nonlinear loads, such as those listed below. Laptops, desktops, printers, and fax machines are just some of the various electronic devices available today. High-efficiency lighting requires the use of electronic ballasts and dimmers. A single phase direct current or alternating current drive Disinfecting UV- radiation-using gadgets. Equipment that can be used in the event of a power outage (UPS). Heating systems that use SCR and arc heaters may be used to control the temperature of a space. One may choose from a variety of battery chargers. AC and DC drives are available for a broad variety of applications.

SIMULATION RESULTS
Table I illustrates the diode rectifier's load and filter simulation settings. An unfiltered simulation result is shown in Figure 5 (below). The power supply's voltage and current waveforms are shown in the following images. Table II provides an example of a passive filter. In a computer simulation, shown in Figure 6, this filter produces voltage and current waveforms. A voltage source inverter is included in the shunt hybrid filter, as is the case with the shunt passive filters listed in Table II. Using hysteresis, P-I, and SHPF controllers, this study compares the results. SHPF and hysteresis controller simulation waves are seen in Figure 7. The SHPF and P-I controller waveforms are shown in Figure 8. An illustration of how much of a contribution to overall harmonic distortion supply current distortion makesis seen in Figure 9. Table IV provides a summary of the results.

7^{th}	C_7=15.7e-3	L_7=0.64e-3

TABLE III
SPECIFICATION PARAMETERS OF ACTIVE FILTER

Inverter dc bus voltage and dc link capacitance	V_{dc} = 50 V, C_{dc} = 3000 μF

TABLE I
SPECIFICATION PARAMETERS OF SUPPLY AND LOAD

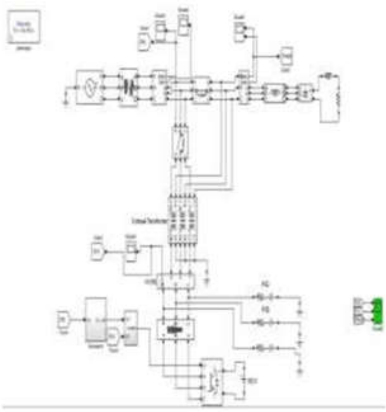
Phase voltage and frequency	V_s=230v(rms),f_s=50Hz
Supply /line inductance	L_{sa}=L_{sb}=L_{sc}=2 mH
Rectifier front-end inductance	L_{ka}=L_{kb}=L_{kc}=30 mH
Load capacitance	C_L=500 μF
Load resistance	R_L= 20 Ω

TABLE II
SHUNT PASSIVE HARMONIC COMPENSATOR PARAMETERS

5^{th}	C_5=11.24e-3	L_5=0.9e-3

7^{th}	C_7=15.7e-3	L_7=0.64e-3

CIRCUIT DIAGRAM



Simulation Outputs:

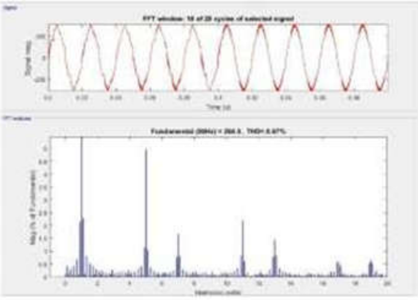


Fig 1 : fft analysis in matlab

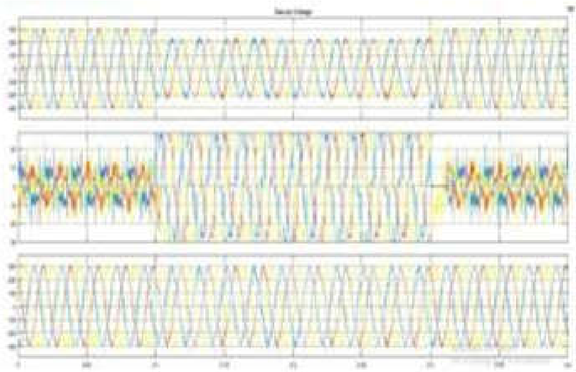


Fig 2 : Vs load

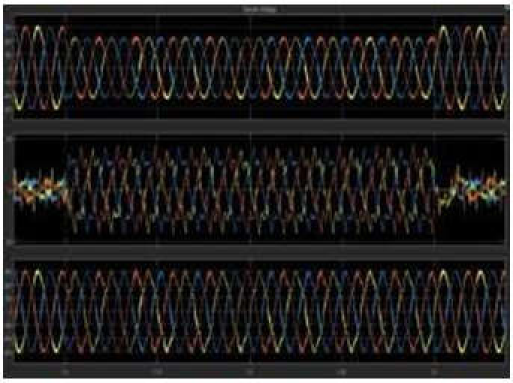


Fig 3 : Vs Vc load

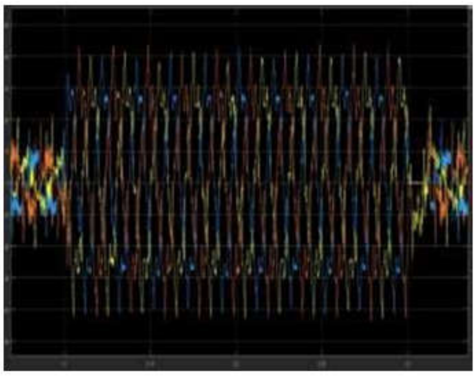


Fig 4: Vc

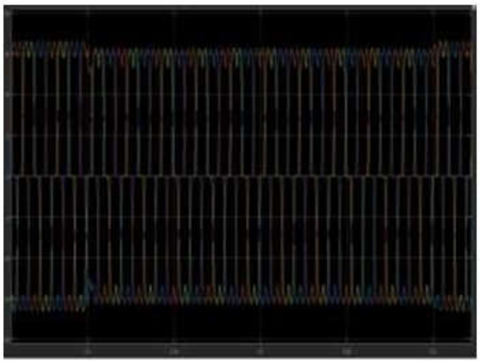


Fig 5 : Iabc

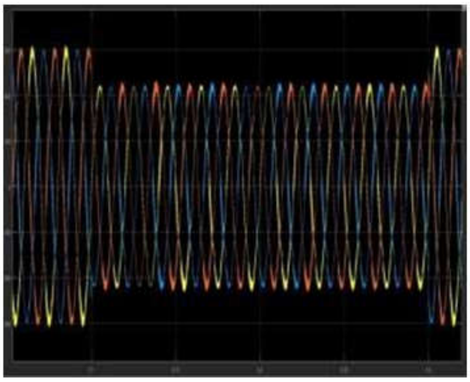
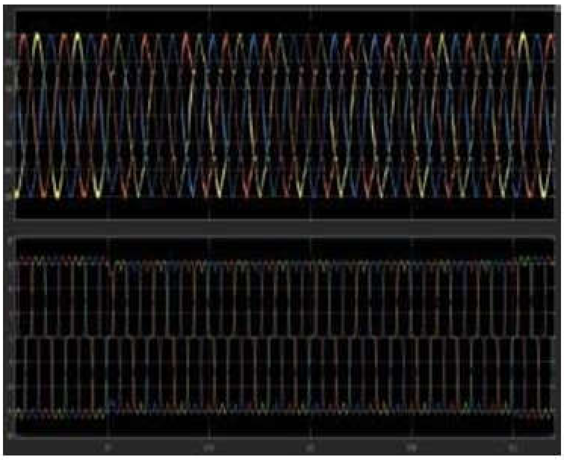


Fig 6 : Vs



$$THD = \frac{1}{v_{01}} \sqrt[2]{\sum_{n=2,3,4,\ldots}^{\infty} v_{on}^{2}}$$

$$THD = \frac{1}{218} \sqrt[2]{2.8161} \times_{100\% = 7.698\%} \approx 8\%$$

Fig 9 : Vabciabc

Comparision of Waveform Results:
Why? A non-harmonic voltage waveform in the power supply is caused by harmonic currents produced by rectification loads. A linear load, such asa resistive one, is required to get a sinusoidal source current (Is). Figure 8 shows the frequency spectrumof the source current if just a passive filter is applied. (Is). The results of this filter's research demonstrate that the mains supply is still getting an excessiveamount of third-harmonic current, despite its stated objective of reducing harmonics in the power supply. Passive filters alone cannot protect against nonlinear loads injecting harmonic currents into the mains. An active filter was all that was required for the simulation findings. According to a frequency spectrum analysis, the source current is a sinusoidal wave with no significant harmonic components. Active power filters may be affected by nonlinear loads, as seen above. In any event, the active power filter offers an intriguing difficulty since it relies on Mosfet ratings. It is for this reason that we developed our hybrid active power filter. Using the hybrid active power filter, below are some additional graphs displaying the results. There seems to be minimal harmonic current in this circumstance. Results showed harmonics from nonlinear loads were reduced by a passive filter equivalent resistor.
According to these simulation results, even after all other filters are turned off, the LCpassive filter continues to draw current. When the dominant frequency (150 Hz) is being filtered to remove the lower order third harmonic, passive filters are used. This distortion may be seen in the mains current, and the THD may be calculated using this method (total harmonic distortion).
THD measures how closely a waveform's fundamental component mimics the shape of the waveform as a whole. The hybrid active filter may effectively minimize nonlinear current harmonics, as shown by simulations. A sine wave is the form of the mains electricity. There is a substantial difference in the THD value of the mains current compared to the estimate above. A range of 2% to 3% is a good estimate. The system's power factor has also been raised to a level above 0.95. The hybrid filter's performance efficiency was used to the fullest extent.

CONCLUSION
Key components of rotating machinery such as gears and bearings have a wide range of industrial applications. Vibrational analysis is the most accuratemethod for determining the condition of spinning machinery. From late detection through diagnosis andbeyond, we've come a long way with the tools we've developed along the way. Several new signal processing methods have emerged in recent years, each of which is well-suited to a certain sort of problem in the research conducted. Filtering and demodulation may be accomplished simultaneously using wavelet multiresolution analysis and the Hilbert transform (Envelope analysis). Researcherswant to use this technique to diagnose gear and bearing problems in spinning machinery as part of this study.

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