DIFFERENT TECHNIQUES OF DIAGNOSTICS FOR ROTATING EQUIPMENT

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Modern technology provides a vast variety of facilities to monitor current conditions of equipment. Various methods and techniques of diagnostics are considered preferably for rotating machines in this paper.

The most rudimentary form of condition monitoring is visual inspection by experienced operators and maintainers. Failure modes such as cracking, leaking, corrosion, etc. can often be detected by visual inspection before failure is likely. This form of condition monitoring is generally the cheapest and is a vital part of workplace culture to give ownership of the equipment to the people that work with it. Consequently, other forms of condition monitoring should generally augment, rather than replace, visual inspection.

Vibration analysis is one of the most commonly used methods. Measurements can be taken on machine bearing casings with seismic or piezo-electric transducers to measure the casing vibrations.

Slight temperature variations across a surface can be discovered with visual inspection and non-destructive testing with thermography. Heat is indicative of failing components, especially degrading electrical contacts and terminations. Thermography can also be successfully applied to high-speed bearings, fluid couplings, conveyor rollers, and storage tank internal build-up.

Using a Scanning Electron Microscope of a carefully taken sample of debris suspended in lubricating oil (taken from filters or magnetic chip detectors). Instruments then reveal the elements contained their proportions, size and morphology. Using this method, the site, the mechanical failure mechanism and the time to eventual failure may be determined. This is called WDA - Wear Debris Analysis.

Spectrographic oil analysis that tests the chemical composition of the oil can be used to predict failure modes. For example, a high silicon content indicates contamination of grit and high iron levels indicate wearing components. Individually, elements give fair indications, but when used together they can very accurately determine failure modes e.g. for internal combustion engines, the presence of iron, and carbon would indicate worn piston rings.

Ultrasound can be used for high-speed and slow-speed mechanical applications and for high-pressure fluid situations. Digital ultrasonic meters measure high frequency signals from bearings and display the result as a dBuV (decibels per microvolt) value. This value is trended over time and used to predict increases in friction, rubbing, impacting, and other bearing defects. The dBuV value is also used to predict proper intervals for re-lubrication. Ultrasound monitoring, if done properly, proves out to be a great companion technology for vibration analysis.

Headphones allow humans to listen to ultrasound as well. A high pitched 'buzzing sound' in bearings indicates flaws in the contact surfaces, and when partial blockages occur in high pressure fluids the orifice will cause a large amount of ultrasonic noise. Ultrasound is used in the Shock Pulse Method of condition monitoring.

Performance analysis, where the physical efficiency, performance, or condition is found by comparing actual parameters against an ideal model. Deterioration is typically the cause of difference in the readings. After motors, centrifugal pumps are arguably the most common machines.

Condition monitoring by a simple head-flow test near duty point using repeatable measurements has long been used but could be more widely adopted. An extension of this method can be used to calculate the best time to overhaul a pump based on balancing the cost of overhaul against the increasing energy consumption that occurs as a pump wears.

Aviation gas turbines are also commonly monitored using performance analysis techniques with the original equipment manufacturers such as Rolls-Royce plc routinely monitoring whole fleets of aircraft engines under Long Term Service Agreements (LTSAs) or Total Care packages.

Wear Debris Detection Sensors are capable of detecting ferrous and non-ferrous wear particles within the lubrication oil giving considerable information about the condition of the measured machinery. By creating and monitoring a trend of what debris is being generated it is possible to detect faults prior to catastrophic failure of rotating equipment such as gearbox's, turbines.

In conclusion, one can say that different techniques of diagnostics for rotating equipment are widely used in modern industry. Moreover there are many researches devoted to investigation of diagnostics in science. The choice of appropriate method of diagnostics depends on investigated rotating machine and its operating parameters.

Here it is significant to mention that the problem to choose the right and effective method of diagnostics is currently studied by many scientists and the importance of this field will be as long in the top as humankind will continue to use all sorts of technology.

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