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TECHTIMES

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Holroyd MHC

These are rugged instruments giving you instant access to powerful conditioning (CM) diagnostic.

If you need information on the condition of rotating machinery and you need it now, the Kittiwake Holroyd MHC instruments are for you.

From day one, Kittiwake Holroyd MHC instruments give you critical information for implementing proactive, rather than reactive, maintenance, even on machinery you have never monitored before. Unlike traditional vibration analysis sensor replacement is easy as its unaffected by plane of the bearing or any specific orientation.

The Holroyd AC Acoustical Vibration sensors are available with a remote handheld kit that allows you to take the sensor out into the feels and measure pump and drive bearings. The handheld device will store tag numbers and a route can be set up for testing purposes.

The Remote kit comes with a software package that can be used to save all your readings. It stores the tag numbers and dates. It will generate a trend in which alarms can be set. Using the Distress value as a guide this become the perfect tool for preventative maintenance.

Kittiwake Holroyd Condition Monitoring Based on Acoustic Emission

When we talk about machinery condition monitoring, we're talking about condition in the sense of a machines ability to continue to perform its intended function in an efficient manner. Unfortunately there is no way to directly measure machine condition and so it is necessary to infer it from indirect measurements. For Condition Monitoring (CM) purposes a range of technologies are available, each having its own strengths and weaknesses, and it is usual to consider each of them as a tool in the CM toolkit.

The Acoustic Emission (AE) technique has a 40 year history of use for machinery condition monitoring and although it got off to a slow start, in recent years it has gained very widespread acceptance across industry. The particular strength of AE is its ability to directly detect the processes associated with wear and degradation (including friction, impacts, crushing, cracking, turbulence, etc,). It does this by detecting the surface component of stress waves that these processes invariably generate. These stress waves travel all over the machines surface, which means that sensor positioning is not critical.

Another convenient feature of AE signals is that they generally have a high Signal to Noise Ratio (SNR), which means that the signals related to machine condition can be clearly seen and are not buried in other inconsequential signals. This is a direct consequence of the high frequency and resonant nature of an AE sensors response. An example of an application that makes full use of this high SNR is the monitoring of blowers in a blower house. This application environment involves very high noise and vibration levels with adjacent identical blowers cutting in and out in response to process demands without warning. Despite this, clear trends of processed AE signals have successfully identified a number of faults including defective motor coupling (*see Figure below showing good and bad examples*) and build up of lime on the rotors enabling wash initiation and avoidance of rotor collision. The high and variable background noise together with the problems of cross-talk and sympathetic resonance from adjacent blowers prevents the successful use of Vibration techniques in this application.

AE sensors, signals and technology have little in common with those of the Vibration technique and this has many positive consequences in practical terms. For example, with AE it isn't a pre-requisite to perform a frequency analysis (or FFT) and interpret the signal levels at all possible defect frequencies before determining whether or not there is a fault. In fact, with AE the usual measurement sequence is the logical and time saving one of:

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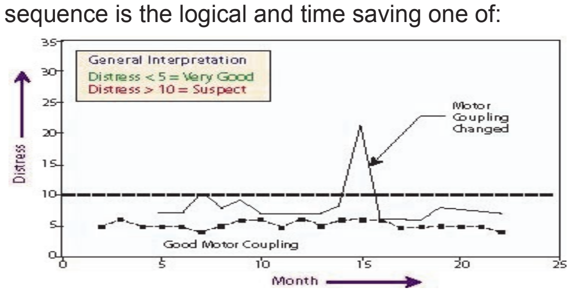


1. *instantly alert to the presence of a fault on a machine without knowledge of machine details (such as bearing type or number),*
2. *only look at the trend of readings to reveal*
3. *only carry out an FFT if diagnostic information is required of a fault condition.*

Memo Software

The simplicity of use of the MHC range of instruments means that complicated analysis software is not required to get a fast, accurate indication of your machinery bearing condition.

However, some users like to have this capability available to make it more familiar with traditional vibration analysis where the process is to diagnose, trend then alert. However, using the MHC technology, you can alert first and then trend and diagnose only if required and to this end, two data capture and analysis software packages are available:

- Memo View Pro - a true machine database logging data (past readings, photo, alarm levels … etc) against a 4 level hierarchical address structure (Site, Area, Machine and Point) with sophisticated report generation capabilities
- Memo View Lab – takes the capabilities of Memo View Pro and extends them to include frequency and harmonic analysis and export of captured data to third party software packages.

MEMO VIEW PRO

Memo View Pro is a full functionality route mode software package for use with the MHC-Memo Pro instrument. It is designed around a machine database with Site, Area, Machine and Point fields of hierarchy. Measurements are taken in Route lists but can be analyzed in flexible Action lists irrespective of which Routes they were taken on.

Report generation is simplified using the Exception Report, Missed Points listing and the summary printouts showing graphical trends, tabulated readings and even user input machine photos. Organization and control of the CM task is further aided by features such as User Notes and a Calendar giving a reminder when measurements need to be taken on specific Routes.

Of course, such a radical departure from the norm was initially met with a fair degree of skepticism along the lines of 'It can't be that easy otherwise why would people use Vibration?' A fair point in its time! The only answer was to relentlessly demonstrate instant fault detection on the shop floors of those who were interested but doubtful. A not untypical example of readings from such a demonstration is shown below for one-off measurements taken with a portable AE based CM instrument (MHC type) on the various white metal bearings of a generating set in a power station. (Note: for this instrument the common interpretation for all types of machines, bearings and rotational speeds

Data &photo courtesy of Corus - CNES

Measure Point	Distress
HP Rotor DE	03
HP Rotor NDE	04
IP Rotor DE	05
IP Rotor NDE	03
LP1 Rotor DE	04
LP1 Rotor NDE	03
LP2 Rotor DE	03
LP2 Rotor NDE	03
Generator Rotor DE	04
Generator Rotor NDE	03
Exciter Rotor DE	19
Exciter Rotor NDE	16
Pilot Exciter	07

Prior to these measurements being taken, the client believed that the main exciter was as good as new. However upon seeing the readings the client explained that the excier had previously shown problems of arcing in the bearings and resulting surface damage had been blended out prior to the bearing being returned to service. The high SNR which AE signals enjoy has other consequences too,

Very slowly rotating machinery

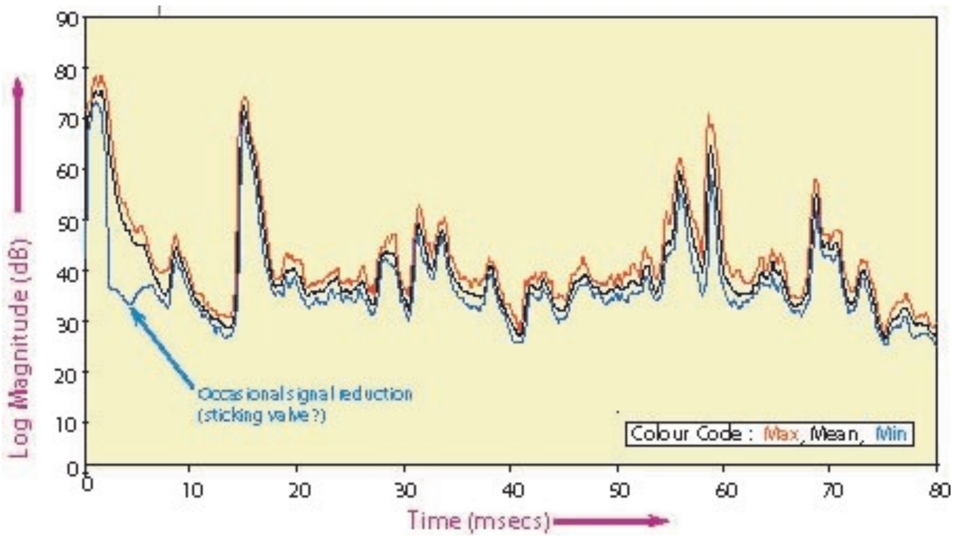
At slow rotational speeds the rate at which AE signals are generated reduces, even becoming infrequent at the lowest speeds. However, this does not necessarily pose a problem provided signals are processed accordingly since AE sensors are insensitive to the low frequency sounds and vibrations which are ever present on the shop floor. Commercially available AE instrumentation is able to easily monitor down to 0.25 rpm without requiring special expertise.

Non-repetitive or random fault types

Because AE signals can be simply analyzed directly in the time domain, without recourse to frequency analysis, they are equally sensitive to non-repetitive signals. One example of this has been the detection of carbonization of oil in a high temperature white metal bearing where the small particles of carbon were crushed in the bearing as they randomly formed. Another example has been the detection of sporadic air bubbles in the oil flowing through a plain bearing.

Reciprocating machinery

It is normal to get load reversals, valve openings/closures, sliding actions and gas transfers during the operation of reciprocating machinery and each of these has an associated AE signature. A full interpretation of the AE signal requires knowledge of the timing sequence of all these actions but it can also be useful to simply observe occasional or persistent variations from the norm. This is illustrated in the Figure below which shows the maximum, minimum and mean values of the AE envelope signal as a function of time within the cycle of a diesel engine over 12 successive engine cycles. Comparison of the minimum and mean waveforms clearly indicates an occasional drop out of part of the operating process (thought to be due to a sticking valve) which is only detectable because of the high SNR of AE signals - a low SNR would have required averaging to reveal the waveform in the first place thus masking exceptional occurrences.



Intermittent actions

Similar comments to those for reciprocating machinery apply to intermittent actions. For a single action the high SNR of AE signals is particularly relevant in allowing the signals to be directly analyzed without the need for averaging of multiple actions.

The high SNR and the resulting suitability of time domain signal processing has had a positive impact on simplifying AE instrumentation. In particular for rotating machinery it has allowed generic time domain signal processing algorithms to be developed which are quick and easy to use. Initially this led to the creation of very simple yet effective portable instruments but, more recently, these algorithms have been incorporated into the AE sensor itself (*see example shown below*). The importance of this development is that it eases the way for the utilization of AE sensors with other technology sensors (such as rms vibration and temperature) in shop floor installations as it removes the need for a separate AE instrument.

With increased understanding of the fundamentals underpinning the use of AE for CM and the overwhelming evidence of its benefits to industry, it is not surprising that AE has gradually moved centre stage over the years. In addition to having its own standard ISO 22096 (*Condition monitoring and diagnostics of machines – Acoustic Emission*) it is specifically listed in the CM standard ISO 18436 (*Condition monitoring and diagnostics of machines – Requirements for qualification and assessment of personnel*) as one of the four main CM techniques, together with Infra-red Thermography, Lubrication Management & Analysis and Vibration Analysis. Alongside these developments the British Institute of Non-Destructive Testing as a UKAS accredited, third party certifying body has recently created a certification programmed of training and examinations that conforms to the ISO 18436 international standard.

MHC - On-line Instruments

The MHC on-line acoustic sensors are DIN rail mounting modules that provide a means of continuous condition based maintenance in either Standard or Super Slo signal processing modes. In addition to outputting processed signal values for external logging purposes, they have built-in alarm functions / outputs as well as an internal long-term trend.

1000 Series sensors - compatible with MHC On-site instruments, similarly the workhorse of MHC sensor

range. Cylindrical bodied instruments for fixed or permanent mount. Various sensor head treatments for challenging environmental conditions. Available also for air/gas leak detection.

2000 Series sensors - 10V drive sensors for permanent installation. Available in low profile (square) or standard profile (cylindrical) format. Fitting and coating options available to suite your unique application.

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MHC sensors are quite unlike conventional sensors for monitoring vibration. The key to their predictive maintenance success is the unique crystal arrangement which enhances sensor to sensor reproducibility and forms the foundation on which successful signal interpretation is based.

The MHC sensor range extends from a simple transducer with integral preamplifier design through to industry leading intelligent microprocessor sensors with:

- built-in alarm levels
- fully processed outputs and
- built-in trend history

MHC - 4000 series sensors (sensors with pre-processed outputs)

The MHC - 4000 series of AE sensors are of an advanced design that incorporates signal processing and alarm functions in addition to the usual AE transducer and signal conditioning electronics. Designed for permanent installation on rotating machinery the outputs of 4000 series sensors are suitable for straightforward connection to third party infrastructure such as PLC's and SCADA systems without the need for additional signal processing units.

HYDROFLO CONTROLS LTD.

886B Alloy Place

Thunder Bay Ont.

P7B 6E6   Canada

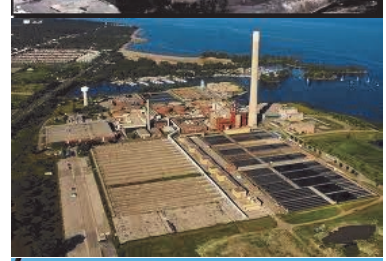
Phone 807-344-4224

Fax   807-344 3580

Web www/:hydroflo.net

MINING

WASTE WATER



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