

Advanced Mathematical Concepts Detect Failure Patterns

Written by Terrence O'Hanlon, ReliabilityWeb.com
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Missiles fired from thousands of miles away hit their assigned targets with precision; automated inspection systems reject manufactured parts that do not meet specifications; and MRIs detect tumors long before the most experienced medical professional.

With all this technology, why is unplanned downtime due to machine breakdown so common in most manufacturing and process industries?

According to Dave Harris, president of Zero Maintenance International, Chicago, IL, these breakdowns can be avoided by using advanced pattern recognition technologies to analyze and interpret a machine's operational data.

Because most machines are computer controlled, they generate operational data including command logs, activity logs, error code logs, and sensor logs. Using a number of advanced techniques such as generic algorithms, multivariate statistics, theories of chaos, topology, neural networks, signal analysis, and mathematical logic, patterns are recognized that define operational situations and can be used to predict problems prior to an unplanned shutdown due to a mechanical or electrical failure.

Experts retire early

As many of the best and most experienced personnel accept early retirement packages, they often take a great deal of "tribal" knowledge with them. This knowledge was passed on in the form of story or simple conversation between these experienced engineers and service people and those who had not yet developed the same experiences.

True Predictive Maintenance (TPM) found that the machines themselves could tell the best story if there were a way of listening and translating what they were saying. TPM applies sophisticated mathematical methods to identify patterns generated by a large number of data sets. Machines that are functioning create certain clusters or points in n-dimension when mathematically mapped. Malfunctioning machines have different parameters and create different clusters.

Zero Maintenance determines the type of pattern recognition technology to be applied on

a case-by-case basis.

TPM vs predictive maintenance

Vibration analysis, used oil analysis, infrared thermography, and ultrasonics are all common predictive technologies in use today to avoid unplanned machinery failure. These techniques rely heavily on how and where sensors are placed, when readings are taken, and how collected data are interpreted.

TPM does not require the addition of any specific type of sensors; rather it relies on any and all available existing data. If data are available from standard predictive technologies, it may be used in the TPM data analysis process; however, it is not required.

In addition, TPM has nothing to do with trend analyses. It makes predictions about machinery breakdowns for each machine based on the pattern at any given moment in time.

Data into knowledge

Pattern recognition techniques allow previously ignored operational data to be transformed into knowledge. That knowledge will assist operators and engineers in assessing the condition of a machine and will allow engineers to develop new insights into how machines behave. Astute designers will use this knowledge to design machines with even better performance and reliability.

The company offers an evaluation service to survey all available machine data that has potential value to the TPM process. This service is being offered at no charge to assist industrial processors and equipment manufacturers transition to the new standards of asset management that artificial intelligence technologies such as TPM allow. **MT**

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