Advanced machine management with Armada CMS

Arnaldo Spiller

Predictive maintenance is gaining in popularity as a productivity tool because it helps eliminate unscheduled downtime of expensive equipment and reduce the overall cost of maintenance.

This approach, sometimes called 'condition-based maintenance', relies on planned inspections, testing, analyzing and trending of the relevant machine parameters – which in most cases can non-intrusively determine a machine's health – and must be followed by proactive actions that change the way machinery is operated to reach the goals set out above. In other words, the performance of machinery is analyzed to determine its condition and predict when it will need attention.

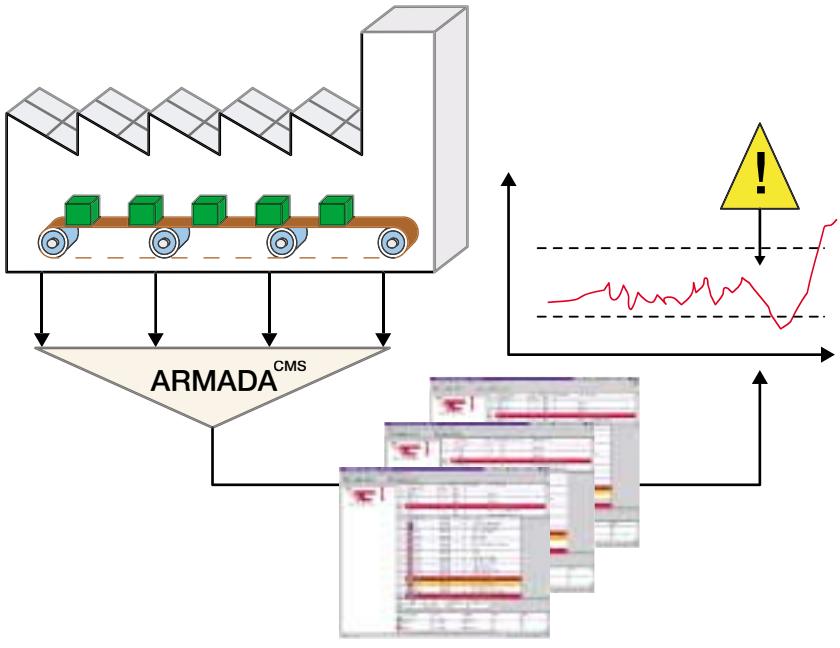
However, a single machine is often maintained by different teams, with no integration across the different engineering disciplines. For example, mechanical and electrical engineering teams monitor the performance of the same motors, each using a wide variety of tools and techniques. The effectiveness of this approach is therefore hampered by segregation of information and uncertainty in the diagnosis of test results. Similarly, suppliers of condition monitoring software tend to specialize in one area or another, focusing only on one type of data – such as, vibration analysis, infrared thermography or oil analysis. These tools usually do not 'talk' to each other, so data are uncoordinated and there is a lack of overall control. Yet the condition of a piece of equipment is a combination of mechanical and electrical factors, and effective analysis requires an integration of data.

ABB has developed an approach that overcomes both these shortcomings, capitalizing on the group's comprehensive engineering skills and field experience.

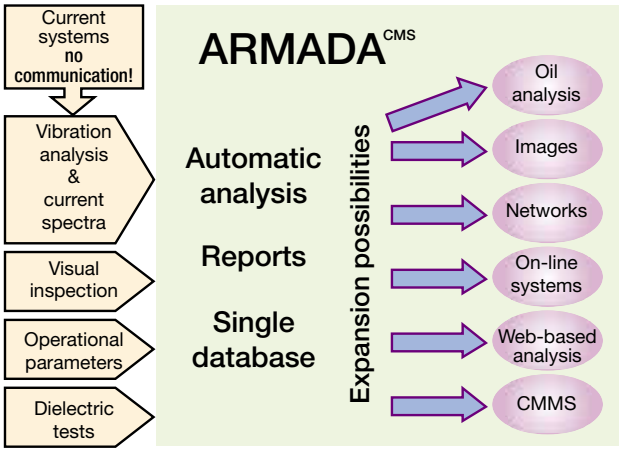
Armada CMS – Advanced Rotating Machines Diagnostic Analysis – is the result of work by ABB teams in Poland, Finland, the United States and India, with key contributions from several other ABB companies around the world, and was developed to offer just such a comprehensive approach. This software tool uses a standard database product to analyze data gathered from a wide variety of tests.

Having the complete range of data – vibrations and operational readings, dielectric characteristics, drive system analysis, etc – in the same database, gives

With the full range of data – currents, temperatures, drive system analysis, etc – in one database, users gain a much more accurate picture of a machine's condition and can immediately see the nature and seriousness of any problem.



Armada^{CMS} integrates several condition monitoring techniques in the same database



Applications for Armada include centrifugal pumps.

a much more accurate picture of a machine's condition than the separate data would.

ABB has developed software to analyze this comprehensive data by comparison with a wide range of real-life machine situations that have been gathered during the development of the system. The analysis is presented clearly and simply so that users can immediately see the nature and seriousness of any problem.

The output consists of a 'traffic light' signal indicating the seriousness of the problems (white, yellow, red) and a simple message indicating the problem which has been diagnosed, for example, 'bearing inner race fault'.

Initially the tool was developed for electric motors, but other applications, such as centrifugal pumps, have meanwhile been introduced.

Vibration- and bearing-related failures account for roughly two-thirds of electric motor problems. The Armada database contains a huge library of defects collected from operating machines, each of which generates a particular type of spectrum when analyzed. The spectra from these data are compared with the library to identify the fault. And since this is a living library the database can be continually improved. Using Armada to identify most common vibration-related problems requires only four measurement points per motor (compared with five or six in traditional analysis).

Thanks to advanced algorithms introduced in Armada, it is possible to determine the rotating speed of a motor much more accurately than with existing methods. The reliability of all analysis depending on the exact rotating speed, such as current spectra analysis to detect broken bars in rotors, and bearing defects analysis, is consequently improved.

The system can also use direct current (DC) absorption tests and other dielectric testing methods to analyze the state of winding insulation. The new method of analysis provides much more detailed and meaningful information than the traditional methods.

The purpose of Armada is not to replace experts, but to perform the analysis of basic problems, allowing engineers to concentrate on more complex situations. It can already be used for online monitoring and the range of applications is steadily being increased.

It is not difficult to imagine a future in which a database of countless machines being continually monitored to identical standards, registering behavior and failure modes, is used to obtain comparative data. Such data mining techniques can teach industry much more about the machine life cycle and enable it to more precisely diagnose complex problems. Remaining lifetime can then be previewed and preventive action taken much earlier than is possible with the conventional methods now in use.

Author

Arnaldo Spiller
Maintenance-tv NV
Belgicastraat 7
BE-1930 Zaventem
Belgium
arnaldo.spiller@be.abb.com
Fax: +32 2 716 55 22