

1.8.23. CORPORATE SYSTEMS FOR MACHINE AND EQUIPMENT CONDITION DIAGNOSTICS

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The new generation of the machine and equipment condition diagnostics systems and their features and peculiarities are described. The systems were designed by Association VAST based on the current ISO standards in field of Condition monitoring and diagnostics of machines.

The main technical solutions incorporated in the systems are:

- Parallel work with different measurement instrumentation and means of signal transmission;
- Use of measurement instrumentation and analysis of operation parameters and secondary processes data in the object under control as well as external diagnostic information;
- Multiuser centralized database;
- Open database structure according to ISO 13374;
- Development of internal means for digital signal analysis of the raw vibration signal;
- Orientation on the multichannel measurement instruments that provide raw data flow;
- Design of portable instruments with automatic diagnostics in field;
- Use of independent rules and knowledge database for the tasks of condition monitoring, automatic and expert diagnostics;
- Remote access to the database, programs for condition monitoring and diagnostics;
- Standard forms for reports of machine condition (health).

For diagnostics and condition prediction of the machines and equipment the system uses measurement data and analysis of operation processes, secondary processes, non-destructive monitoring conducted during maintenance as well as periodic non-destructive tests. A wide range of measurement instrumentation is typically available on the modern enterprises, for example in the control systems, non-destructive testing and monitoring systems. But not always it is possible to collect all these data in a common diagnostic systems due to non compatibility of data or database formats. Introduction of the ISO 13374 standard “Condition monitoring and diagnostics of machines. Data processing, communication and presentation” allowed practical use of open system architecture suggested by international MIMOSA alliance base on the CRIS information model that was implemented in the database of the new generation of condition monitoring and diagnostic systems by Association VAST.

There are two way for importing external measurement data to the open database – using OPC technology and direct access to the database. In the later case a special software module should be designed for each measurement instrument to enter data in the corporate database. Such a program can be designed by the customer using open database description and instrument data exchange protocol.

The depth of signal analysis used in the monitoring and control systems of the enterprise as well as non-destructive testing and monitoring is typically insufficient for the application of modern machines and equipment condition diagnostics algorithms. There are two ways to overcome such a problem in the designed corporate system. The first way

uses the internal signal analysis modules of the diagnostics system. The second is the use of portable measurements instruments with integrated advanced extended analysis features as well as the use of multichannel stand and on-line measurement instrumentation that feed the raw signal flow to the internal signal analysis modules of the diagnostic system. Nowadays a wide library of different signal analysis modules and automatic definition of defect levels for different parameters is designed and constantly improved for the corporate system.

Multichannel devices for parallel measurement of diagnostic signals are designed and improved. There are called network measurement devices (NMD) with a task to register and transmit via standard digital communication channels just the raw diagnostic signal to the centralized processing and signal analysis center. Such NMD designed by Association VAST does not include any complicated data analysis algorithms, just some simple analysis with alarming when some rapid changes in signal level are detected. This allows significant decrease in costs of on-line systems hardware.

Diagnostic measurement devices are designed with integrated signal analysis modules but typically specification includes requirements on the automatic diagnostics of the machinery in field. Two main methods are used to achieve such a goal. One is device operating in the on-line connection to the remote diagnostic system, the other method is integration of the automatic diagnostics modules in the measurement device firmware. In the later case the route map transferred from the host computer to the measurement device contains not only the measurements setups, but a part on condition monitoring and diagnostics database as well as alarm levels. Such an instrument should nicely supplement the existing range of compatible to diagnostic system portable analyzers and data collectors.

To solve diagnostic problem one should use all information provided by operating and secondary processes monitoring systems, diagnostic systems based on rigid algorithms chosen by system designers and expert diagnostics based on rules formed by an expert for each monitored object. During monitoring first of all the parameters are measured for which condition zones are set up by standards or regulations, secondary stationary and random trends for these parameters are analyzed. Constantly improved software modules by Association VAST that make automatic condition diagnostics by known defect symptoms and automatically form levels for defects by group of identical objects proved their efficiency in numerous industries and, that's why, they are widely used in corporate diagnostic system as one of the channels for defect detection and identification.

The main task for expert diagnostics is summing up all data available from condition monitoring, automatic diagnostics, and other direct and indirect data on condition of the object and conditions of operation to form the final diagnosis for the object condition. To enter these data in the system of quantitative estimation of object condition the expert diagnostic program is designed. Such a system should be adapted by an expert entering typical defect symptoms and decision making algorithms. An expert can enter in this program the data about operating parameters, non-destructive monitoring and tests data, any indirect information, combine this information with condition monitoring and automatic diagnostics data thus forming final diagnosis of the object health. Correction of the final diagnosis can be made only experts that are authorized to do so.

Corporate system is used by experts, managers, maintenance personnel, economists, logistics personnel and others. All of them can have remote access to the system to retrieve needed information, but only experts of higher qualification should have rights to

change database and diagnostic results. These experts may not belong to the staff of the enterprise. All necessary means of information acquisition and exchange are included in the developed corporate system. A special program allowing access to the system via Internet is designed. Such a program allows involving any experts, independent on their location, in works on efficient maintenance of any complicated machinery and equipment.