Issues of developing intelligent measuring transducer for distributed condition monitoring systems

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The structure of measuring transducers for condition monitoring systems used for distributed smart industries that implement the ideology of Industry 4.0 should include: autonomous intelligent primary measuring transducer, providing the ability to coupling with elements of technological equipment; wireless interface for remote data exchange via digital communication channels; a virtual secondary measuring transducer based on a digital multi-parameter multi-level model "measuring transducer - object of control", integrated into the monitoring system. To ensure the necessary reliability and accuracy of the measuring information, the intelligent measuring transducer must have the function of metrological self-checking and the possibility of remote calibration. Modern communication technologies make it easy to solve the problem of remote data exchange. However, to build distributed NDT and condition monitoring systems, it is necessary to solve the following tasks: development and approval of the universal format for the presentation of data on measuring or testing device and measurement information; creation of a software platform for data exchange, as well as the collection and processing of information from sensors connected to the Internet. Methods of metrological self-checking of measuring transducers are divided into methods of direct and diagnostic self-checking. The most promising metrological diagnostic self-checking, which monitors the deviation of the diagnostic parameter characterizing the critical component of the error from the reference value of this parameter set during calibration. Critical components include, for example, the aging of materials, defects caused by violations of the manufacturing technology of sensor, which appear only over time, etc. Diagnostic self-checking at relatively low cost, as a rule, can be implemented in the entire range of measurements and / or dynamic characteristics of measuring transducers and measuring systems. The introduction of means and methods of self-checking of NDT tools is directly related to the development of the metrological concept of multi-parameter measurements. The essence of this concept is that the measurement result depends on a combination of various parameters that cannot be unambiguously divided into informative and disturbing (influencing) ones. To obtain a reliable result, it is necessary to measure the values of all key parameters, or to control their change. The task of remote sensors calibration can be solving in several ways: embedding sources of reference values of measured values in the sensors. This method can be attributed to direct self-checking in accordance to; creation of mobile standards for calibration of sensors without dismantling at the place of operation; development of devices that provide a normalized effect on the object of control to determine the metrological serviceability of the sensors placed on them. To solve the above problems when creating intelligent sensors and NDT tools, coordination between the development engineers, metrologists and standardization technical committees is necessary. In the report practical examples of the implementation of multi-parameter intelligent eddy-current amplitude-phase measuring transducers for non-contact measurement of the thickness of functional metal coatings, as well as the electromagnetic parameters of the materials of products that implement the above concept will be presented.