

4.5.31. DEVELOPMENT OF COMBINED METHODS FOR NONDESTRUCTIVE TESTING AND DIAGNOSTICS

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For the last 30 years, combined nondestructive testing methods using various physical phenomena for expansion of functional possibilities, increasing of the number of informative parameters and accuracy of their determination during diagnostics of articles of complex shape and structure were widely developed in the MSUIMCS. For this scientific trend, scientific school was created at the department "Electrotechnics and Electronics", where 5 theses for the Doctor's degree (by Steblev Yu.I., Shkatov P.M., Lazarev S.F., Sannikov A.A., Filinov V.V.) and more than 20 theses for the Candidate's degree were prepared and defended, 5 monographs and more than 50 scientific articles were published and 20 patent for invention were obtained. Moreover, there were designed testing and diagnostic instruments and combined sets of "PION", IFS, "Surface", "Relief", "Zond-VD", "Zond-IGT" and other types. Several hundreds of them are applied for diagnostic of energetic machines and installations, aerospace and defensive equipment, aircrafts, equipment of nuclear thermal power stations, equipment in petrochemical, metallurgical, electronic, machine-building and other industry branches.

Paper discusses development of these combined nondestructive testing methods for the last 10 years by the following scientific directions:

- Electromagnetic-thermal method (research manager: Shaternikov V.E., Doctor of Science, Professor);
- Selective measurement of geometric, electro- and thermophysical parameters for flaw detection and determination of physic-mechanical properties of materials and articles with complex structure, including nanomaterials;
- Electromagnetic-electric method (research manager: Shkatov P.N., Doctor of Science, Professor), where electric, magnetic and eddy-current nondestructive testing methods are used for detection of defects of various types and accurate determination of their parameters in articles and structures of complex shape in the process of their long-term operation;
- Magnetic-acoustic method (research manager: Filinov V.V., Doctor of Science, Professor), where residual mechanical stress in ferromagnetic articles is determined using Barkhausen effect on the basis of measurement and analysis of occurred magnetic and acoustic noises;
- Energetic-radiation method, where the work of electrons emitting from « α »-radiated surface is determined by the difference of potentials and surface quality, degree of its degradation, surface mechanical stresses and pre-destruction stage of important structural parts and elements are determined basing on the computer processing of measurement results.

In more details, main results of theoretical researches and practical applications are presented in stand papers of above indicated authors.