1.7.23. NEW APPROACHES IN ACOUSTIC EMISSION SIGNAL PROCESSING

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The main tasks of acoustic emission testing of objects operating in a static or dynamic stress are localization and identification of acoustic radiation. At present, AE methods are based on time difference of impulse input on spaced transducers estimation and classification of sources according to hazard level, as a rule, based on analysis of radiation process power parameters and their temporal changes. The aim of the present research is an attempt to choose optimal wavelet- functions and to perform continuous (CWT) wavelet analysis of AE signals received from different sources (mainly from simulators) on different objects. Acquisition of AE signals oscillograms allows making approaches to solution of these problems from a perspective of a more subtle AE radiation analysis based on modern signal processing methods. Wavelet transductions exhibit a time-and-frequency signals localization characteristic, fast calculating algorithms which is one of the main requirements for identification and detection systems.

In conditions of nonstationarity of AE acoustic signals, presence of forced acoustic background (industrial, transport etc.) and also natural noises coming from pre-reflections etc., make the wavelet-functions the preferable basis for solving the assigned task.

Wavelet transductions technique allows examining the structure of a registered AE signal and to substantively estimate the distribution route and allocation of its energy in frequency band. The performed researches have shown that the continuous wavelet transduction gives the most obvious picture of an object under testing as an acoustic channel.

A transmitting characteristic acquired on the basis of amplitude frequency characteristic of utilized transducers, can serve as a parent function for creation of wavelet functions that allow examining signals, localizing its power not only by time but also by frequency, in this case quantities of wavelet functions are virtually unlimited and determined by a combination of polynominal roots of a transmitting characteristic.

Wavelet signal notation gives an opportunity to filter signals as genuine ones in AE testing, since in the range of frequencies and thicknesses of elements of an object under examination that serve as an acoustic channel, as a rule, AE energy can allocate only as Lamb waves.

Wavelet transductions allow determining a distance to the source by two ways: by determination of a time of symmetric and antisymmetric mode input at the selected frequency, or by antisymmetric mode as a time difference of energy input of this mode at different frequencies.