

ACOUSTICS2008/1889 Scattering of ultrasonic waves in randomly layered materials

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The goal of the paper is the proposal of a new macroscopic description of scattering of elastic waves at internal inhomogeneities of the material. Within the studies the microscopic inhomogeneity of the medium is modeled as the alternately arranged two kinds of elastic layers of random thicknesses and different mechanical properties. Calculations of the acoustical characteristics of such medium (reflection and transmission coefficients) are performed in two stages: (i) first the problem of interaction of plane harmonic wave with the half space of the randomly layered medium for the case of normal wave incidence is analyzed; (ii) then the interaction of the harmonic wave with the slice composed of randomly layered structure is considered. Such approach allowed to derive analytical relations for the phase velocity of wave propagation and attenuation as the explicit functions of frequency, stochastic structural parameters of the medium and material properties of layers. The obtained formulas are helpful for interpretation of experimental ultrasonic data and may serve for identification of the characteristic size of material inhomogeneity based on the measured wave parameters like frequency dependent phase velocity, attenuation as well as backscattering coefficient.