Elastic Property Estimation of Surface Layer of Layered Structure by Measuring Love Wave Propagation Characteristics using Laser Doppler Vibrometer

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The surface properties of a layered structure are useful parameters for coating materials such as functionally graded materials. A Love wave is dispersive, and its propagation characteristics depend on the properties of the material in which in propagates. On this basis, we present an innovative method for measuring the elastic properties of the surface using piezoelectric vibrators and a laser Doppler vibrometer (LDV). Specifically, a Love wave was excited on the surface of a layered structure, and the displacement of the Love wave propagating along the surface layer of the specimen was measured using an LDV. The obtained data were processed in the frequency-wavenumber domain to extract the dispersion curves, and the material properties that minimized the difference between the theoretical and experimental curves were calculated. Experiments were carried out on two materials – poly(methyl methacrylate) and polystyrene – and the shear wave velocity and thickness of the surface layer were successfully estimated within a relative error of 10%.

Keywords : Love wave, laser Doppler vibrometer, dispersion curve, inverse problem, elastic property