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Elastic waves in one-dimensional unconsolidated medium with Hertz nonlinearity

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Results of experimental study of elastic longitudinal harmonic wave's propagation in one-dimensional unconsolidated medium are presented. A 1-D chain of identical pre-pressed beads is used as an experimental model. To describe elastic properties of such medium the Hertz model is used. Presence of periodical structure causes elastic waves to be dispersive in such medium and to have a cutoff frequency. A cutoff frequency depends not only on material's elastic properties and beads' geometrical sizes but also on pre-press value. Velocity dependence on frequency of longitudinal harmonic wave of small magnitude is measured experimentally, and dispersion curves are built under different pre-press value. Pre-press value is regulated with applied external static force along chain axis. Measured dispersion dependences are in good agreement with theoretically calculated ones. Dispersion impedes observation of higher harmonics generation in such chain. Therefore to study nonlinear properties of 1-D structure, velocity dependence on longitudinal wave amplitude were investigated. The wave velocity depends not only on its magnitude but also on pre-press value on beads. It was experimentally shown the one-dimensional chain of elastic beads is a medium with dispersion, linear and nonlinear properties to be controlled with the applied external static force. Work supported by RFBR.