



## **Numerical experiments on nonlinear compressional waves in marine sediments**

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The nonlinear progressive wave equation (NPE) [McDonald and Kuperman, JASA 81, 1406, 1987] was initially developed to model weakly nonlinear compressional waves in a refracting medium (specifically ocean acoustic convergence zones). The NPE is currently being used to examine nonlinear propagation into marine sediments. An intriguing behavior results from the stress- strain relation for Hertzian granular media, in which stress is proportional to the  $3/2$  power of strain rate. Numerical and analytic solutions with the Hertzian nonlinearity reveal its most evident nonlinear behavior (shock formation) near zero stress, whereas in a fluid, shock formation results from high stress. Numerical experiments are presented to determine whether shocks resulting from Hertzian nonlinearity can be observed with nominal values of frequency- linear attenuation common to granular media, using nonlinear sources (a lithotripter-like device and an airgun). The experiments employ dimensional analysis of an effective medium equation of state model for nonlinear compressional waves. Work supported by the U. S. Office of Naval Research.