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Nonlinear scattering of a surface wave by an object buried in soil

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Nonlinear scattering of a surface wave by an object buried in soil is investigated theoretically. The object is supposed to be excited by a monochromatic seismic wave and its pulsations are considered to be nonlinear. Specific features of soil are taken into account, namely, shear modulus less than compressibility modulus and anomalously high nonlinearity. Two analytical approaches are applied. One is based on theory of elasticity and the other is based on fluid mechanics. The two approaches yield identical results for the second harmonic in the scattered field. The second harmonic is evaluated in the near field where the medium can be considered as incompressible. The analysis is performed with perturbation theory for small displacement amplitudes in the soil. The second harmonic is also investigated with an asymptotic expression obtained from the general equation for the second harmonic generated by a pulsating object in a compressible medium. The equation is expanded for a small object at distances that are small compared with a wavelength. The influence of a stress-free boundary on the scattered field is evaluated using Green's functions. [Work supported by ONR.]