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Anelastic Seismic Pulse Propagation through a Hysteretic Elastic Material using a Realistic Consitutive Relation DAN KOSIK, Butler University — The stress-strain relation for unconsolidated or slightly consolidated materials that exhibit hysteretic elastic behavior are often modeled for small strains by higher order terms in the strain with derivative terms or for large strains by linear viscoelastic models. In this way, anelastic behavior is introduced with the characteristic nonlinear wave propagation that has attenuation and dispersion along with higher harmonics generated. A more natural approach is to use the Preisach-Mayergoyz method to model the stress-strain relation as due to opening and closing of void spaces in the material. This leads to a much more realistic stress-strain curve as compared to experimental tests of soil and sand with much of the guess work about what higher order terms should be included removed. For parameters characteristic of sand and soil at the Earth's surface, a comparison of nonlinear to linear seismic pulse propagation shows a nonlinear seismic pulse with a slower propagation speed, dispersion, and attenuation with the development of higher frequency harmonics. As a source input to a 2D model of surface ground roll generation, nonlinear surface wave motion can be studied with the aim to better understand how to attenuate this coherent noise contribution to seismic data.

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