Geophysical Research Abstracts
Vol. 20, EGU2018-18185, 2018
EGU General Assembly 2018
© Author(s) 2018. CC Attribution 4.0 license.

Energy dissipation in problems of wave propagation through bimodular media

Maria Kuznetsova (1), Arcady Dyskin (1), and Elena Pasternak (2)

(1) University of Western Australia, School of Engineering, Dept. of Civil, Environment and Mining Engineering, Crawley, Australia (arcady_m@me.com), (2) University of Western Australia, School of Engineering, Dept of Mechanical Engineering

The problem of nonlinear wave propagation in bimodular media, i.e. materials with different elastic moduli in compression and tension, is considered challenging as it requires special numerical methods for constructing numerical solutions to the nonlinear partial differential equations of hyperbolic type with the discontinuity of the deformation and stress.
To date, the analysis of one-dimensional wave propagation problems in bimodular media has been carried out mostly by various asymptotic techniques. These techniques are effective only when the elastic moduli in tension and compression are close to each other. In the present work the full problem of wave dynamics in a one-dimensional bimodular medium is studied. It is assumed that the material may have large difference between the moduli in tension and compression and is subjected to the sign-alternating loading in the absence of numerical damping, as this case leads to the energy dissipation in the considered system.
The proposed model is based on the explicit Godunov's scheme with the so-called predictor-corrector solver and takes into account nonlinear effects occurring at the wavefront, i.e. interaction between compressive and tensile waves in the case of sign-alternating loading. It is shown how to numerically estimate the speed of the wavefront and the amount of energy dissipated in the system. The theoretical estimation of the energy loss due to the discontinuity in the deformation is derived and a good correspondence between analytical and numerical results is demonstrated.