Geophysical Research Abstracts
Vol. 18, EGU2016-6352, 2016
EGU General Assembly 2016

Wave Propagation in Bimodular Geomaterials

Maria Kuznetsova (1), Elena Pasternak (2), Arcady Dyskin (1), and Efim Pelinovsky (3)

(1) University of Western Australia, School of Civil, Environment and Mining Engineering, Crawley, Australia (arcady_m@me.com), (2) University of Western Australia, Mechanical and Chemical Engineering, Crawley, Australia, (3) Department of Nonlinear Geophysical Processes Institute of Applied Physics, Russian Academy of Sciences

Observations and laboratory experiments show that fragmented or layered geomaterials have the mechanical response dependent on the sign of the load. The most adequate model accounting for this effect is the theory of bimodular (bilinear) elasticity – a hyperelastic model with different elastic moduli for tension and compression. For most of geo- and structural materials (cohesionless soils, rocks, concrete, etc.) the difference between elastic moduli is such that their modulus in compression is considerably higher than that in tension. This feature has a profound effect on oscillations [1]; however, its effect on wave propagation has not been comprehensively investigated. It is believed that incorporation of bilinear elastic constitutive equations within theory of wave dynamics will bring a deeper insight to the study of mechanical behaviour of many geomaterials. The aim of this paper is to construct a mathematical model and develop analytical methods and numerical algorithms for analysing wave propagation in bimodular materials. Geophysical and exploration applications and applications in structural engineering are envisaged.

The FEM modelling of wave propagation in a 1D semi-infinite bimodular material has been performed with the use of Marlow potential [2]. In the case of the initial load expressed by a harmonic pulse loading strong dependence on the pulse sign is observed: when tension is applied before compression, the phenomenon of disappearance of negative (compressive) strains takes place.

References

1. Dyskin, A., Pasternak, E., & Pelinovsky, E. (2012). Periodic motions and resonances of impact oscillators. Journal of Sound and Vibration, 331(12), 2856-2873.

2. Marlow, R. S. (2008). A Second-Invariant Extension of the Marlow Model: Representing Tension and Compression Data Exactly. In ABAQUS Users' Conference.