Geophysical Research Abstracts
Vol. 19, EGU2017-17386, 2017
EGU General Assembly 2017

Kelvin-Voigt model of wave propagation in fragmented geomaterials with impact damping

Maxim Khudyakov (3), Elena Pasternak (2), and Arcady Dyskin (1)

(1) University of Western Australia, School of Civil, Environment and Mining Engineering, Crawley, Australia (arcady_m@me.com), (2) University of Western Australia, School of Mechanical and Chemical Engineering, Crawley, Australia (elena.pasternak@uwa.edu.au), (3) University of Western Australia, School of Civil, Environment and Mining Engineering, Crawley, Australia (maxim.khudyakov@research.uwa.edu.au)

When a wave propagates through real materials, energy dissipation occurs. The effect of loss of energy in homogeneous materials can be accounted for by using simple viscous models. However, a reliable model representing the effect in fragmented geomaterials has not been established yet. The main reason for that is a mechanism how vibrations are transmitted between the elements (fragments) in these materials. It is hypothesised that the fragments strike against each other, in the process of oscillation, and the impacts lead to the energy loss. We assume that the energy loss is well represented by the restitution coefficient.
The principal element of this concept is the interaction of two adjacent blocks. We model it by a simple linear oscillator (a mass on an elastic spring) with an additional condition: each time the system travels through the neutral point, where the displacement is equal to zero, the velocity reduces by multiplying itself by the restitution coefficient, which characterises an impact of the fragments. This additional condition renders the system non-linear.
We show that the behaviour of such a model averaged over times much larger than the system period can approximately be represented by a conventional linear oscillator with linear damping characterised by a damping coefficient expressible through the restitution coefficient. Based on this the wave propagation at times considerably greater than the resonance period of oscillations of the neighbouring blocks can be modelled using the Kelvin-Voigt model. The wave velocities and the dispersion relations are obtained.