Geophysical Research Abstracts
Vol. 20, EGU2018-18208-1, 2018
EGU General Assembly 2018

Dynamics of fragmented media

Maxim Khudyakov (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

Fragmented geomaterials consisting of blocks (fragments) that can move and rotate independent of each other. In some circumstances the relative movement of fragments is caused by external vibrations (e.g., waves) leading to fragment oscillations. Due to their limited movement, the neighbouring fragments can collide dissipating energy. When the fragments collide in the process of mutual rotation, the loss of energy falls to the neutral states, while the rest of the trajectory of oscillations can remain elastic.

In this study, forced oscillations of a pair of neighbouring fragments are analysed as a basic element of the process of fragment movement with energy dissipation on mutual collisions. The mathematical model of the interaction is represented as a forced undamped oscillator coupled with an additional condition: each time the system travels through the neutral points of the mass trajectory, the velocity is reduced by a coefficient of restitution (COR) smaller than one. As a result, the system transforms to piecewise linear with the non-linearity concentrated at the neutral points.

Numerical modelling shows that the behaviour of the model is influenced by three main parameters: the COR, the excitation frequency to natural frequency ratio, and the initial phase of the excitation. It was observed that the system can have periodic, asymmetric, and erratic non-periodic (chaotic) behaviour and energy dissipation does not always reduce with the decrease of COR. Also, it is found that, for odd super-harmonics, non-dissipative vibrations can occur either from the very beginning or after some stabilisation time.