Geophysical Research Abstracts
Vol. 19, EGU2017-17376, 2017
EGU General Assembly 2017

Chaotic dynamics of fragmented geomaterials

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

(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)

Fragmented geomaterials consist of blocks that have a certain degree of independent movement. The principal element of the analysis of wave propagation in such materials is the interaction between two fragments with dissipation of energy occurring due to impacts.
We model this interaction as a linear oscillator, consisting of a single mass and a linear spring, with the energy dissipation localised at the neutral points of the trajectory of the mass. The presence of the energy dissipation, characterised by a restitution coefficient smaller than one, at the neutral point turns the system into nonlinear, while it is linear between the impacts.
Analysis of forced vibrations of the system shows that chaotic behaviour appears under special conditions. First, the value of the restitution coefficient should be small and, second, the forced frequency should be in a region close to odd numbers of super-harmonics. However, even in the case when both conditions are met, the initial phase and/or boundary conditions can affect the appearance of chaos.
The emergence of chaotic behaviour can disrupt wave propagation and, thus, be confused with the effect of dissipative strata. This may affect the quality of a reconstruction of the Earth's crust structure.