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Nonlinear inversion for wave fields monitoring data in hierarchic heterogeneous media

Olga Hachay (1), Andrey Khachay (2), and Oleg Khachay (3)

(1) Institute of Geophysics, Ural's Department of RAS, Yekaterinburg, Russian Federation (olgakhachay@yandex.ru), (2) Ural Federal University, Institute of mathematics and computer sciences, Mira str., 19, Yekaterinburg, 620002, Russian Federation (khachay@gmail.com), (3) 2Ural Federal University, Institute of mathematics and computer sciences, Mira str., 19, Yekaterinburg, 620002, Russian Federation (khachay@yandex.ru)

Geological medium is an open system which is influenced by outer and inner factors that can lead it to a unstable state. That non stability is as a rule occurred locally and these zones are named as dynamically active elements, which are indicators of potential catastrophic sources. These objects differ from the embedded geological medium by their structural forms, which often are of hierarchical type. The process of their activisation can be searched, using wave fields monitoring. For that purpose it is needed to develop new algorithms of modeling wave fields propagation through the local objects with hierarchical structure. Also it is needed to develop new theory of interpretation the distribution of wave fields for defining the contours of these local hierarchical objects.
It had been constructed an algorithm for 3D modeling electromagnetic field for arbitrary type of source of excitation in N-layered medium with a hierarchic conductive intrusion, located in the layer number J. It had been constructed algorithms for 2D modeling of sound diffraction and linear polarized transversal seismic wave on an intrusion of hierarchic structure, located in the layer number J of N-layered elastic medium. We used the method of integral and integral-differential equations for a space frequency presentation of wave fields distribution. It is developed an algorithm for constructing the equation of theoretical inverse problem for 2-D electromagnetic field of E and H polarization and linear polarized longitudinal elastic wave by excitation of the N-layered conductive or elastic medium with hierarchic conductive or elastic inclusion located in the ν –th layer.
From the theory it is obviously that for such complicated medium each wave field contains its own information about the inner structure of the hierarchical inclusion. Therefore it is needed to interpret the monitoring data for each wave field apart, and not mixes the data base.
These results will be the base for constructing new systems of monitoring observations of dynamical geological systems. Especially it is needed to prevent rock shocks in deep mines by their exploitation.