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Using of GeoMark geoinformation system for solving of seismoacoustic tasks in mining

O.O. Glukhov, A.V. Antsyferov, M.G. Tirkel, V.A. Antsyferov, and L.A. Kamburova
UkrNIMI,Donetsk, Ukraine (glukhov@ukrnimi.donetsk.ua)

The report gives a description of methods of using GeoMark geoinforma-tion system for solving of geophysical tasks in mining. It has been devel-oped in the UkrNIMI Institute to solve a wide range of computational prob-lems in the field of mine and land geophysics, geomechanics, and mine-surveying.
A multi-purpose GeoMark geoinformation system (GIS) has been devel-oped in the UkrNIMI Institute to solve a wide range of problems:
- to generate 3D models of surface relief, coal seams, tectonic faults, mine workings and other geological and industrial objects of mine fields and open pit mines;
- to predict or calculate state, composition and properties of rock mass in any point of the Earth's slice within mine field;
- to calculate and analyze variations of various parameters in depth of rock mass obtained on the basis of in situ geophysical, geological, geo-chemical surveys and other types of surveys.
- to solve wide range of problems related to the determination of small-amplitude tectonic dislocations with a break of continuity of coal seams us-ing geophysical and seismoacoustic techniques.
GeoMark GIS is widely used when conducting acoustic survey as an in-strument to integrate geological, geophysical and mine surveying data. Be-sides, the system is used to generate computer models for preliminary as-sessment of the features of seismic vibrations propagation in conditions of specific areas of minefields and as a tool for analysis and processing of seismic prediction data. The final target of the research is detection and de-scription of coal seam faults. Geophysical module uses some versions of finite-difference approach to calculate wave propagation processes and to predict their technological parameters. At the first stage, based on the mine-field electronic model, spatial locations of the main geologic and industrial structures are specified. If required, location of different types of geological faults can be specified. These are disjunctions, plicative dislocations, coal seam washes, clastic injections.
For each of the objects that form the model values of parameters neces-sary for calculation of seismic wave fields are specified. They are values of rock density, modulus of rupture or compression and shear waves, coeffi-cient of vibration damping.
As a result, we have 3D geophysical model of coal series area. By divid-ing it into low-level cells, we shall obtain a model grid for application of finite difference method to solve new 3D wave equations. To obtain more simple two-dimensional models, a module for generation of geological sec-tions is used. Sections of three-dimensional geological and industrial ob-jects, geological faults and their effect zones as well as zones of rock sof-tening form two-chamber areas which in their turn are divided into low-level cells in order to apply 2D finite difference method.
These models serve as a basis to apply a group of computational stages in the limits of which computation of finite-difference coefficient represen-tation and simulation of the process of wave field propagation is made. Based on the computational results, methods of field survey and conditions for optimal recording of the most informative wavetrains are selected.
After fulfillment of field seismoacoustic experiments, their results are processed and interpreted. It is clear that interpretation is made based on the previous analysis of a priori geological, geophysical, and other data. In addition, interpretation may require repeated fulfillment of the stage in-volved in generation of more adequate physical-mathematical models to clear up or to specify the nature of the recorded wavetrains or to analyze in detail any features of recorded signals. The result of this stage is prediction of the type and parameters of coal seam

disturbance within the zone of ex-periments. The results of prediction are reflected in the minefield model.