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Tomography version in seismic prediction of rock mass structure

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Prediction of rock mass structure by seismic method rests on the employment of a set of criteria that are evidence of existence of either one or another geological structure and anomaly. The most effective approach to determine anomaly response is seismic tomography. In mining geophysics when using seismic sounding by channel waves, tomography methods are widely employed.

The area under consideration is divided into zones e_{ij}. For each of the e_{ij} a set of seismic traces K is used, which rays pass through the given zone. Based on the values of responses A_k, ray path distances from the source to the seismograph R_k and their path lengths $r_{k,ij}$ the value of A_{ij} response is being estimated by e_{ij}, which seismic traces would have if the whole rock mass had the same parameters as in the zone e_{ij}.

This extremely efficient method to predict mining and geological conditions of coal occurrence finds no dissemination in solving problems of land seismic exploration. Impossibility to employ it without special adaptation is due to the fact that in solving practical problems not passing waves but reflected waves are used. Adaptation of this method is an extremely urgent problem, solution of which would allow improving efficiency and quality of seismic prediction.

Some principles of new approach have been worked out in UkrNIMI Institute with the help of which structure of coal-rock mass can be described by analyzing wave trains reflected from sharp acoustic boundaries. Idea underlying the suggested approach is that any anomaly can be described by means of processing of wave trains reflected from sharp acoustic boundary that lies behind it (relative to EP).

Method consists of two parts: theoretical and practical. Theoretical part of this one may be used on the stage of analysis of *a priori* data by finite-difference methods of mathematical modeling. It is very effective approach in order to work out the most optimum conditions of making experiments. Practical part may be used on the stage of analysis of its results.

Field of tomography application in the proposed version is limited by those cases when reflected from sharp acoustic boundary waves reach seismograph with amplitude sufficient for further processing. Hence, between EP and rock anomaly there must be similar physical and mechanical parameters (with a difference no more than 5-10%). Theoretical calculations have shown that existence of even one acoustic boundary of the sharpness more than 20% between EP and anomaly could in certain cases practically completely shield the wave reflected from dense rocks lying deeper.

Suggested approach can also be used in mining seismic exploration if prediction is required between two mine workings in one of which it is impossible to arrange excitations points and seismographers. Then, along with application of traditional reflection method, one can use tomography employing as informative waves those reflected from another mine working.