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ACOUSTIC CONTROL OF THE DEPTH OF EXPLORATION AND PRODUCTION WELLS AT MINING ENTERPRISES

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Abstract:

This article consists in acoustic control of the depth of search and mining wells in mining enterprises, the study of the work of their Crusaders and other scientists

Keywords: technological process, well, acoustic measurements, alarm, technical means, control object

In the technological process of the mining industry, a special place is given to working with wells drilled for blasting, settlement and research work. Errors in determining the depth of the well lead to a deterioration in the quality of the preparatory stage of blasting and, as a result, to an increase in the cost of the extracted rock mass. The development of new equipment for monitoring the depth of the well will not only reduce the complexity, but also increase the quality of preparation of blasting operations.

To date, the devices presented on the market do not meet the requirements of the surveying services of mining enterprises, as they have significant limitations in use and low accuracy, often require regular tuning and the presence of a reference well, and therefore are not widely used, and most surveying and geodetic departments continue to monitor the depth of the well, using measuring tapes with a weighting device or rigid hoses for measuring wells drilled vertically upwards.

A significant contribution to improving the accuracy of acoustic measurements was made by foreign scientists: L. Angrisani, S.S. Huang, F.E. Gueuning, L. Mazeika, V. Samaitis, K. Burnham and others. Research work on the development of methods for processing received signals in order to improve accuracy is described in the PhD thesis of P.V. Sorokin, the doctoral dissertation of A.I. Soldatov.

It is possible to increase the accuracy of determining geometric dimensions by increasing the frequency of radiation, which in turn, due to signal attenuation, leads to a decrease in the measured range, therefore, various signal processing methods have been widely developed: the method of one comparator, the method of two comparators, allowing to increase the accuracy of measurements, significantly reducing the measurement error associated with

Deviation of the waveguide from the ideal geometric shape, as well as due to waveguide propagation of the signal.

The purpose of the study is to develop a new method and technical means for monitoring the depth of a well drilled for blasting, settlement and research work.

To research tasks:

- Development of a mathematical model of signal propagation through a circular cross-sectional waveguide.
- Development of a two-frequency method for ultrasound examination of the control object.
- Determination of the nature of the impact of sensing and acoustic path parameters on depth measurement errors, such as the length and diameter of the well, deviation of the well from the ideal cylindrical shape, etc.
- Conducting experimental research on the accuracy of acoustic measurements by a two-frequency method of well inspection.
- Determination of technical and operational requirements for an acoustic well depth gauge.
- Development of a sample sample acoustic well locator.
- The object of research is the acoustic tract of the well depth meter.

A two-frequency signal processing method has been developed to determine the moment of arrival of the Echo impulse by comparing the propagation time of the elastic wave at different frequencies and calculating the time coordinates of the first period of both Echoes, which allows you to increase the accuracy of the ultrasonic locator.

- The nature of the impact of acoustic path parameters was determined, which is a circular cross-sectional waveguide with solid walls (frequency ratio, well diameter, well depth, well deviation from the cylindrical shape, sensing parameters) to the accuracy of control.
- The nature of the influence of the control parameters on the control accuracy was determined. It is indicated to achieve the smallest control error for the ratio of probe frequencies from 1:1.05 to 1:1.25.

- To compensate for the error of the ultrasound locator, an algorithm for calculating the coordinate of the device and the start time of the echo signal was created, which allows you to double the control accuracy compared to analogues.

The practical significance lies in the fact that:

- a two-frequency sensing method has been developed, the novelty of which is confirmed by two patents for inventions,
- proposed circuit solutions for the implementation of an acoustic locator, protected by patents of the Russian Federation.
- an algorithm for processing acoustic signals has been developed, protected by a certificate of registration of computer programs.
- a model for the analysis of the acoustic path is proposed, which allows determining the optimal ratio of the probing frequencies.

The main provisions submitted for protection

- a mathematical model of a circular-section waveguide acoustic tract with rigid walls based on the method of geometric acoustics, which allows conducting research in a wide range of changes in the parameters of sounding and acoustic tract
- a method for determining the time coordinate of an echo pulse during two-frequency probing of the control object, which reduces the error in determining the distance by half compared to analogues.
- to achieve the minimum error of the control results (less than 0.5%), it is necessary to choose a frequency ratio in the range from 1:1.05 to 1:1.25.

REFERENCES:

1. Буровзрывные работы / П.Я.Торанов. - М.: Недра, 1964. - 258 с.
2. Hilbert Transform and Its Engineering Applications // AIAA Journal, 2009, Vol.47, №4, pp. 923-932.
3. Гармонические колебания и волны в упругих средах / Гринченко В. Т., Мелешко В. В. - Киев: Наук, думка, 1981. - 284 с.
4. Grimaldi, D. (2006). Time-of-flight measurement of ultrasonic pulse echoes using wavelet networks. IEEE Transactions on Instrumentation and Measurement, 55(1), 5-13.
5. L.Mazeika, V.Samaitis, K.Burnham, K.Makaya. Investigations of the guided wave data analysis capabilities in structural health monitoring of composite objects // ULTRAGARSAS (ULTRASOUND), 2011, Vol. 66 No. 3, pp. 7-12.