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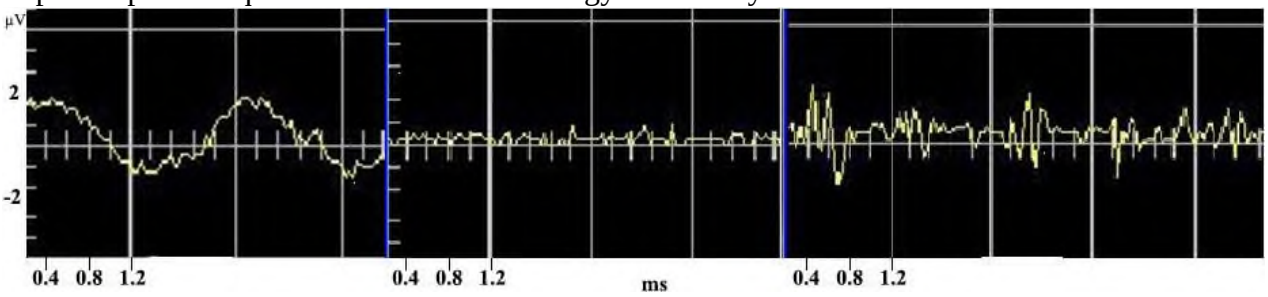
INVESTIGATION OF STRUCTURAL EVOLUTION IN THE CEMENT CONGLOMERATES USING OF ACOUSTIC EMISSION METHODOLOGY

The paper considers issues related to concrete fastenings of mine workings during the construction and reconstruction of mines.

The nature of the manifestation of rock pressure in the mine is determined by the stress state of the rock mass, as well as by the strength and rheological properties of the rocks containing the mine. An important role is played by the composition of concrete and its interaction with the structure of the rock for further stability and durability of the fastening system. Water in the concrete mix in the moment of laying in the formwork of the production support is in the state of: chemical (hydration and crystallization 4-5 %), physical and chemical (adsorption 20-25%) and mechanical connection (water capture in thin capillaries, pores 70-75%) [1]. The influence of water on the strength of the concrete structure is very high, which imposes special requirements on the technology of delivery of concrete mix.



0-45 min

cement + water colloid crystal formation

Figure 1 – Type of signals on an oscilloscope excited in a cement test at various stages of structure formation

In this paper, the rheology of cement stone is considered. Even though concrete technology has made great advancements, the exact interpretation of phenomena and interaction between different physical and chemical parameters are yet to be precisely determined. Monitoring of the early stage of the material is important as this stage defines in a great degree the final properties of the hardened concrete.Within the different monitoring techniques, acoustic emission (AE) has been recently increasingly used as it shows sensitivity capturing numerous elastic wave signals during the setting of the material and as early as from the moment of mixing [2]. The relationship between the levels of structure formation of the concrete structure and the AE signals in these periods is established.

The destructive effect of concrete lining is influenced by the aggressive environment.The Cl^- ion easily migrates through the cement dough, while the rate of diffusion depends on the Cl^-/OH^- ratio. In cement stone, the migration of Cl^- ions occurs through areas of increased permeability: microcracks, capillaries, and open pores. The binding of Cl^- ions and their diffusion capacity determines the intensity of chloride corrosion. To determine the structural changes in concrete, the AE method has proven itself. In the future, it is planned to study structural changes in concrete under the influence of an aggressive environment using a measuring complex combining AE and strain measurement methods.

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APPLICATION OF THE NEWTON METHOD IN SOLVING OF THE OPTIMIZATION GEODETIC TASKS

Various optimization methods are used in geodesy nowadays. Usually the main task in an optimization problem is to search for an optimal solution (i.e., in terms of the conditions of the problem). There are a lot of problems in geodesy, where it’s necessary to solve diverse systems of nonlinear equations. Processing of different coordinate systems, geodetic network adjustment, creating of digital terrain model can serve as an example of such geodetic problems. The advent of computer technology enhances the search for new methods of solving nonlinear equations using nonlinear programming. Nonlinear programming methods involve the process of optimizing objective functions connecting known and desired (unknown) parameters. However, one cannot choose one method that would solve all the problems in modern geodesy without exception. The article presents a study of the possibility of using nonlinear programming methods in solving various geodetic problems. This topic is devoted to the work of prominent scientists: Himmelblau [1], Mitskevich [2], Kougiya [3]. In this article, the basic ideas of Newton’s methods and theirs application to solve geodetic problems are considered. Additionally, the question of using computer technologies for the realization of Newton’s method is presented in this paper. By applying this method, solutions are found using an objective function, its first and second derivatives. The advantage of the Newton’s method is the quadratic convergence of the solution – a more perfect search algorithm in comparison with the gradient methods and the possibility to apply it when solving systems of nonlinear equations. However, this method requires prediction: it is necessary to evaluate the first and the second derivatives of the objective function in advance. This procedure can be time-consuming. In this