Computer modelling for dynamic failure of pit walls

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The problem of ensuring the safety of near-pit edge massifs in open pit mines throughout their life cycle requires constant improvement and a corresponding adjustment of the existing methods for assessing its sustainability. The issues of determining the parameters of the pit walls have been considered in detail in works of domestic and foreign scientists (G.L. Fisenko, N.V. Melnikov, K.N. Trubetskoy, B.P. Yumatov, B.N. Baikov, et al).

Works to strengthen the slopes and strengthen the rocks of the massifs in the near-contour zones became a reliable link in mining production to ensure the safety of quarries and improving the completeness, the development and improvement of which is an important national economic task.

Under certain conditions, a possible self-collapse of pit edge under cer-tain conditions can be interpreted as a dynamic transition of a system from one quasi-equilibrium state to another under the influence of internal, avalanche-like, unfolding processes in the trigger effect mode.

Such a transformation occurs due to the achievement in the rock of mas-sive of a certain limiting state and is initiated by a certain trigger signal, the value of which is greater than a certain acceptable level associated with the structure and structure of the rock and depending on the degree of its stresses.

In this work, the modeling of processes is performed for conditions of plane deformation. A complete excavation of a massive block of rock in a short period of time is simulated. The model of elastic - plastic deformation is used, the parameters of which depend on the damage accumulation index determined by Drucker - Prager ratio. In addition, the applied numerical code of Smoothed Particle Hydrodynamics implements a dual model of representation of the damage to the geo-environment, which reflects the loosening of the rock when the specified failuure criterion is met and the material particles diverge when the interaction forces are lost, determined by the algorithm of the numerical method. This computational approach allowed realistically enough to simulate the processes of deformation and failure in the vicinity of open-pit bench and pit walls.

In this paper, the study of the process is carried out taking into account the mechanism of damage accumulation, which can be described as a trigger effect in the failure, because, as modeling has shown, in the anthropogenic conditions under consideration, such accumulation leads to unstable shear damage and should appear as a dynamic event .

The damage of the massive, earned by the excavation of a large block, is a dynamic displacement, failure, fracture and fragmentation of a rock under its own weight of the entire overhanging stratum in height. This dynamic movement ends with the collapse of the rock to the bottom of the pit. The process of sequential fragmentation, the for-mation of large blocks and their dynamic displacement explains the systemic manifestation of geodynamic phenomena, manifested in the form of clusters on seismograms obtained in seismic sensors located in the thickness of the rock massive.

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