anomaly of intense shear stresses. Most zones of methane accumulation predicted by a set of independent techniques are also connected with this anomaly. At the second stage for more detailed analysis of deformation processes in sedimentation mass within the limits of mine field analysis of attitude of coal seam m_3 was made. As an outcome we received a layout of local folding that complicates close monoclinal bedding of this seam and represents difference of the seam surface and its approximating surface which is polynomial of third order. Comparing a layout of local folds with dynamic phenomena and predicted zones of methane accumulation we can insist that majority of them is confined to gradient zone of local folds. The nature of this zone is closely connected with the processes that are embodied in anomalies of intensity of local shear stresses. Regularities determined within the limits of A. F. Zasyadko Mine field confirm assumptions on connection of certain components of stress field caused by disturbance of equilibrium state with deformation processes developed in sedimentation mass and zones of development of dynamic processes embodied in it.

The authors are convinced that in investigation of dynamic phenomena in geologic environment, independently of their scale — earthquakes, rock bursts, gas-dynamic phenomena and others — the most important element is study of all whole factors, starting from planetary and ending by local ones, which result in disturbance of equilibrium state of the planet and cause occurrence of mechanical stresses in the outer shells of the Earth.

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Computer-aided investigation of fault zone deformation response to low-amplitude dynamic mechanical actions

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An important direction in mechanics is investigation of features of mechanical response of geological media. An important feature of geomedium is that its fragments are in complex stressed state. Relation of internal stresses to strength characteristics of interfacial regions (faults and cracks) appreciably defines deformation and relaxation capacity of the mechanism concerned with relative block displacement. As the shear stress at an active block boundary reaches limiting (threshold) value, its local deformation mode can change qualitatively from slow deformation (creeping) to dynamic deformation (referred to as unsTable sliding). Note that according to modern notion, acts of dynamic block sliding are seismogenerating events those magnitude can reach 6—7. Thus, an urgent task in geomechanics is to develop methods of estimating the local stress state at active interfaces of fragments of rock massifs or the earth's crust. Theoretical studies as well as experiments on prestressed rock samples and fragments of plane discontinuities in rock massifs revealed an important effect consisting in deformation response of geomedium to dynamic perturbations of stress state in form of irreversible relative displacement of blocks. This allowed different authors to formulate the idea about the possibility of estimation of shear stress level in the fragments of active fault zones by measuring deformation response on testing dynamic actions. Nevertheless to transform this idea into practical approach it is necessary to have information about the character of connection between shear stress level in interfacial zone and deformation response to dynamic perturbation of local stress state. This information could be obtained in particular on the base of computer-aided simulation of fragments of block interfaces being under complex stress condition. In the present paper this study was done with use of the movable cellular automaton method (MCA). This method is a variant of particle method and over last decade successfully employed for studying the peculiarities of deformation and fracture of indurated, unconsolidated and loose media.

For solving the problem posed, a two-dimensional structural model of the interface between elements of a block medium was developed in the framework of movable cellular automaton method. The model includes the interface itself and contiguous block fragments. The model blocks were assumed to be monolithic, brittle and of high strength. The mechanical response of interfacial region featured irreversible strain accumulation and simulated the mechanical properties of a cataclasites. For mathematical description of elastoplastic response of the interface and of the blocks in the framework of the MCA method, the model described in was used. The lower surface of the specimen was rigidly fixed while external load was applied to the upper surface. The initial stress state of the system was specified by applying an external force with normal and tangential components to the upper surface of the model specimen with subsequent relaxation of the system. In the calculations, we used different values of normal force, whose specific value varied in the range from 20 to 40 % of the yield stress of interface material. Deformation response of model interface to dynamic pulse testing loading by *P*- and *S*-waves was studied.

Simulation results showed that the dynamically initiated displacement of the upper block along the interface varies over order of magnitude with the shear stress level, and this variation has a clearly defined nonlinear character. If the shear stress level approaches some critical value, qualitative variations occur in deformation response of the interface to dynamic loading. Revealed effect is important for formulation of the approach to diagnostics of stress state of block interfaces in block-structured geomedium. Note that character of interface deformation response defines to a great extent not only by shear stress level, but by applied normal load and by type of incident wave as well. Under large normal load the region of great increase of initiated shear displacement extends far in the stage of so-called quasiplastic interface response. Effective slope of this region therewith decreases nearly proportional to increase of normal stresses. Hence character of change of block boundary deformation response to testing pulse actions by compressive *P*-waves with shear stress level is appreciably defined by normal stress value. At the same time, pulse testing actions with use of elastic *S*-waves looks more promising. Results of investigation shows, that dependencies of shear displacements on shear stresse at different normal stresses are close to each other. The region of great increase of shear displacement is strongly pronounced in all cases, and its completion is associated with the point of transition from quasielastic to quasiplastic response stage. Hence characteristics of interface shear deformation response to dynamic exposure to *S*-waves insignificantly depend on value of normal stress.

Simulation results allowed authors to propose the way to development of an approach to diagnostics of shear stress level at sections of active faults of structural blocks in rock massif. The approach could be based on long-time monitoring of dynamics of natural and man-caused displacements in studied part of active block boundary. It is shown that both theoretical and experimental study of deformation response of real fragments of fault zones to testing pulse dynamic exposure could be carried out with use of local sources of pulse perturbations of stress state, which generate mainly *S*-waves. In that case obtained data about interface deformation response could be interpreted the most unambiguously and will reliably characterize the shear stress level, i.e. the proximity of shear stress at the interface to the current value of stress corresponding to beginning of the stage of “macroscopic” irreversible deformation.

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