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

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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