MATHEMATICAL MODELING OF NON-STATIONARY PROCESSES IN SEISMIC ACTIVITY ZONE

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The processes of phase transition of large volumes of rocks before earthquakes from an undisturbed state to a state of dynamic destruction under compression conditions at great depths occur slowly, which can be used for prognostic purposes [1]. Through natural waveguides, which are fault zones, these processes cause variations in geophysical fields on the earth's surface, changes in the parameters of the ionosphere, which can be seen by modern ground-based and satellite observations. This report presents the results of mathematical modeling of dynamic and quasi-static processes in earthquake source zones. The motion of an elastic medium in the case of a sudden onset of a discontinuity along a finite strip under conditions of longitudinal shear is studied, taking into account contact viscous friction. The use of the exact solution of this problem constructed by the superposition method [2] is convenient for the first arrivals of reflected waves, but difficult for multiple reflections. In this regard, this paper considers a different approach, which consists in reducing the boundary value problem to the integral Fredholm equation of the 2nd kind in images, the solution of which, under certain conditions, makes it possible to obtain the parameters of the motion of the medium at an arbitrary moment of time. These conditions are a sufficiently large value of the viscosity η, at fracture (for $\eta > \eta^*$), when a non-stationary quasi-static process is realized. From the conditions of closeness of the approximate (quasi-static) solution and the general (dynamic) solution of the integral equation, an estimate of the value of the parameter η^* is obtained. Using analytical methods, together with numerical calculation, graphs of non-stationary displacements of discontinuity faces and stress concentration at its ends at an arbitrary moment of time for large values of viscous interaction of discontinuity faces are obtained. A general solution of a quasi-static problem is obtained in the form of a static surface in a normalized coordinate system.

1 Kim A.S. Mechanics of non-stationary processes in focal zones of the earth's crust. - Almaty: Galym ordasy, 2017. - 282 p. / ISBN 978-601-80618-2-0 (In Russian)

2 Kim A.S. Mathematical modeling of dynamic processes in the lithosphere in the event of a sudden rupture // Izvestia NTO "KAKHAK". - 2016. - No. 2 (53). - P. 53-64.