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The calculation of the destruction of elastoplastic bodies

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The numerical simulation of unsteady two-dimensional continual damage of stochastically inhomogeneous elastic-plastic medium is performed by using the criterion of the maximal principal deformation. The accumulation of microcracks is characterized by damage parameter subjected to kinetic equation. The growing damage causes a loss of resistance to deformation ability of the medium. In narrow damaged zones the modulus of elasticity and yield limit tend to zero, deformations tend to infinity and displacements demontrate jump. The resulting solution mimics the inner contact surface type macrocrack.

The simulation has been made for plain strain state elastic plastic body of quadratic cross section with several (10-20) differently oriented elliptical pores and rigid inclusions. We studied the effect of multiple defects on the averaged strain-stress state. Numerical experiments show that the distribution of damaged material zones is strongly dependent on the shape and size of grid cells, while the integral characteristics of the solution (the evolution of strain –stress state of average) converge to a common limit for different meshes. This important fact shows that the approach to simulate the properties of real media has some of the required properties to ensure the reliability of results.

Stochastic heterogeneity of strength properties was simulated by using a random numbers generator. Scatter of properties provokes formation of fractal structure of zones of damaged material.

The simulation is applied to study the fractal structures, simulating hydraulic fracture of geomaterial near the drill-holes loaded with internal pressure. Further research is directed to assess the effect of fracture on filtration properties. Preliminary results of this assessment have been obtained by means of direct numerical calculations of unsteady filtration, deformation and fracture of porous elastic-plastic mediums.

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