COMPUTING OF DAMAGE

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The overview of major approaches to computer modelling of damage may be found in [1]. In present study on the basis of damage theory several new problems are investigated[1]. В рамках подхода теории поврежденности численно решен ряд новых задач.

In Fig. 1 and 2 the solution of problem about damage of extended elastic plastic plates with circular and elliptic macropores and rigid inclusions is demonstrated. The influence of microdefects such as micropores (volumetric plastic strains), dislocations (deviatoric plastic strains) and microcracks (damage) is taken into account

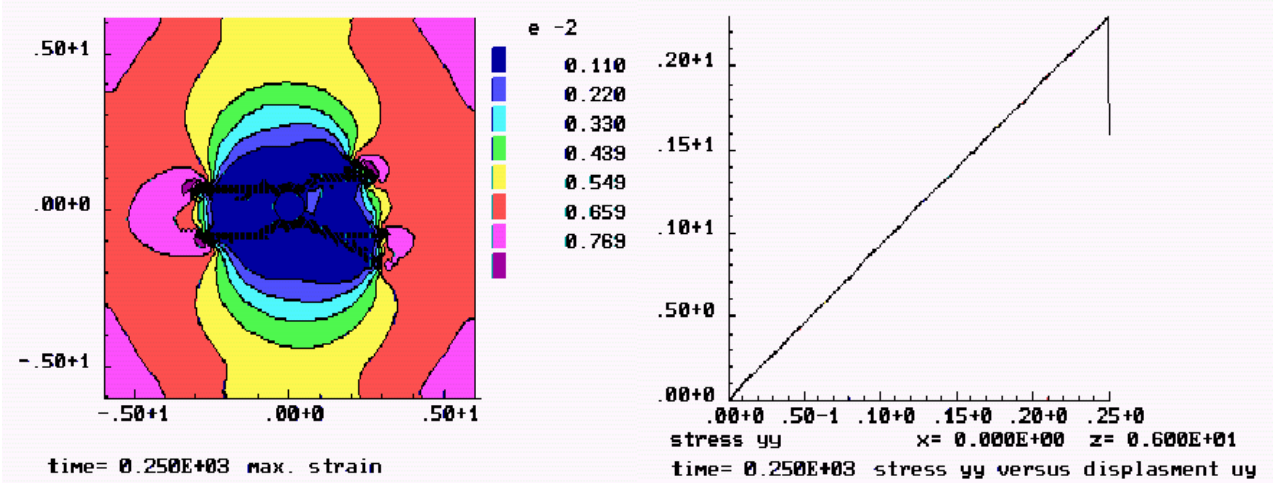

Fig. 1. The damage near rigid circular inclusion. Black narrow zones simulate developing macro-cracks. Colors correspond to the values of strain $\varepsilon_x + \varepsilon_y$. On the right the dependence of stress σ_y on desplacement U_y at point ($x = 0$, $y = 6$) is shown.

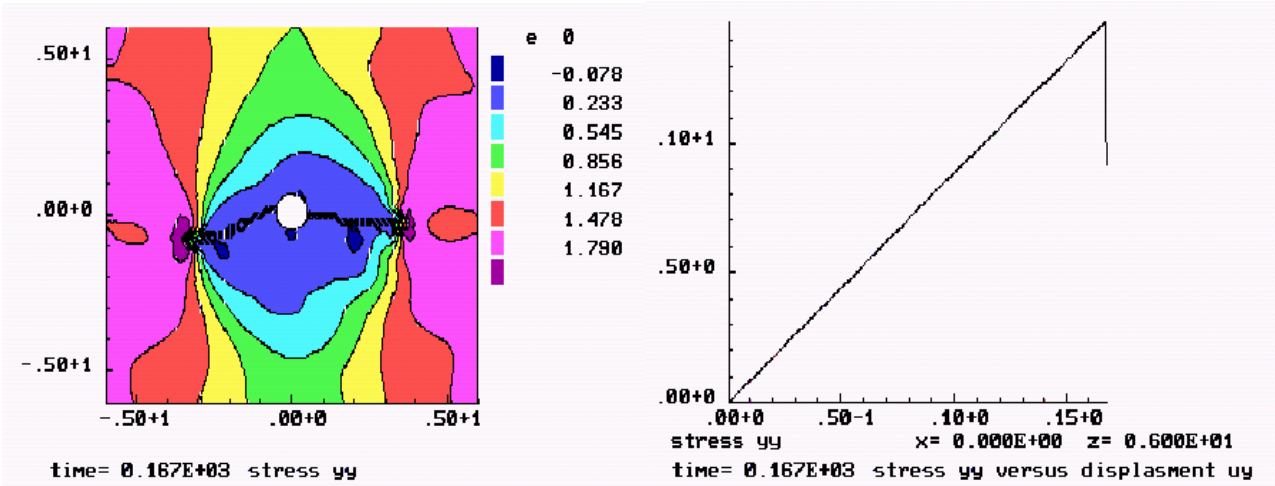

Fig. 2. The damage near circular pore. Black narrow zone simulate developing macrocracks. Colors correspond to the values of strain $\varepsilon_x + \varepsilon_y$. On the right the dependence of stress σ_y on displacement U_y at point ($x = 0$, $y = 6$) is shown.

Both cases, produced in Fig. 1 and 2, deal with isotropic elastic material.

[1] Current research is supported by RFBR project 05-01-245 and by RAS programs OE-13, OE-14

The difference in type of damage is explained by the difference in strain concentration near the pore and near the inclusion. This may be seen in Fig. 3.

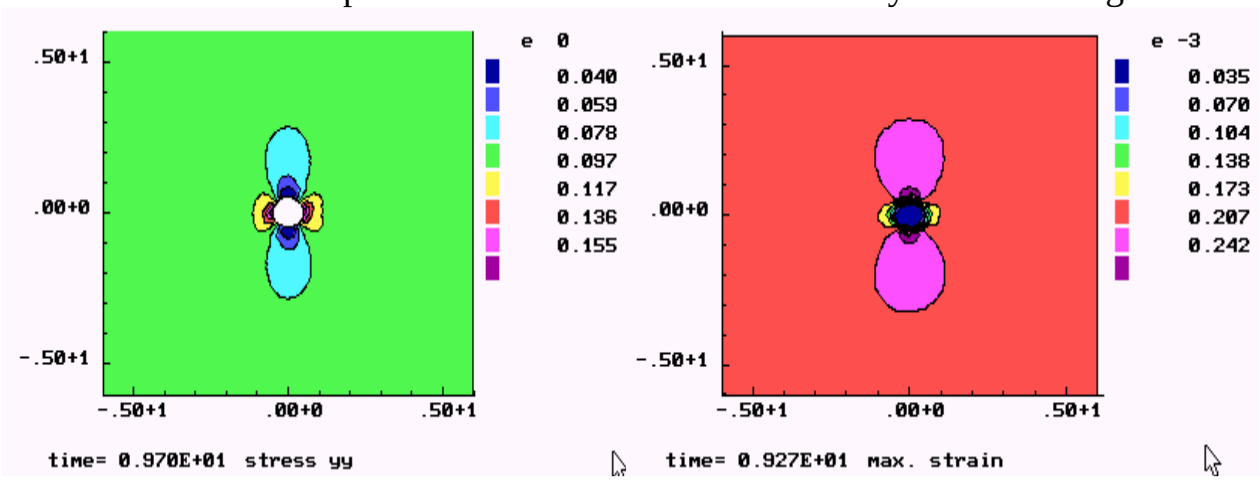

Fig. 3. Strain concentration near the pore (on the left) and near the inclusion (on the right). Dark magenta corresponds to the maximal strain value.

We used the damage criterion formulated in terms of maximal principal strains. Therefore, in case of pore the damage begins in west-east points at pore surface while in case of inclusion the damage begins in nord-south points at inclusion surface.

In Fig. 4 the influence of natural stochastic inhomogeneous distribution of damage strain limit is demonstrated for the problem about oil drillhole under the internal pressure. It results in fractal structure of multiple macrocracks development.

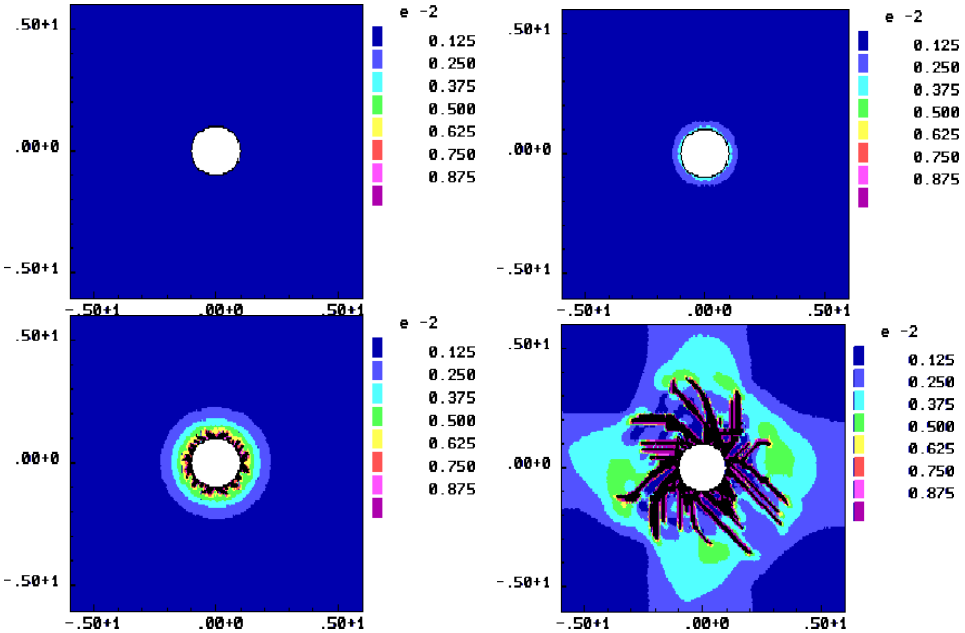

Fig. 2. The fractal system of macrocracks development near drillhole under internal pressure. Principal strain distribution in virgin material is axisymmetric. But due to stochastic spatial inhomogeneuity of strain limit the multiple macrocracks are appeared and developed.

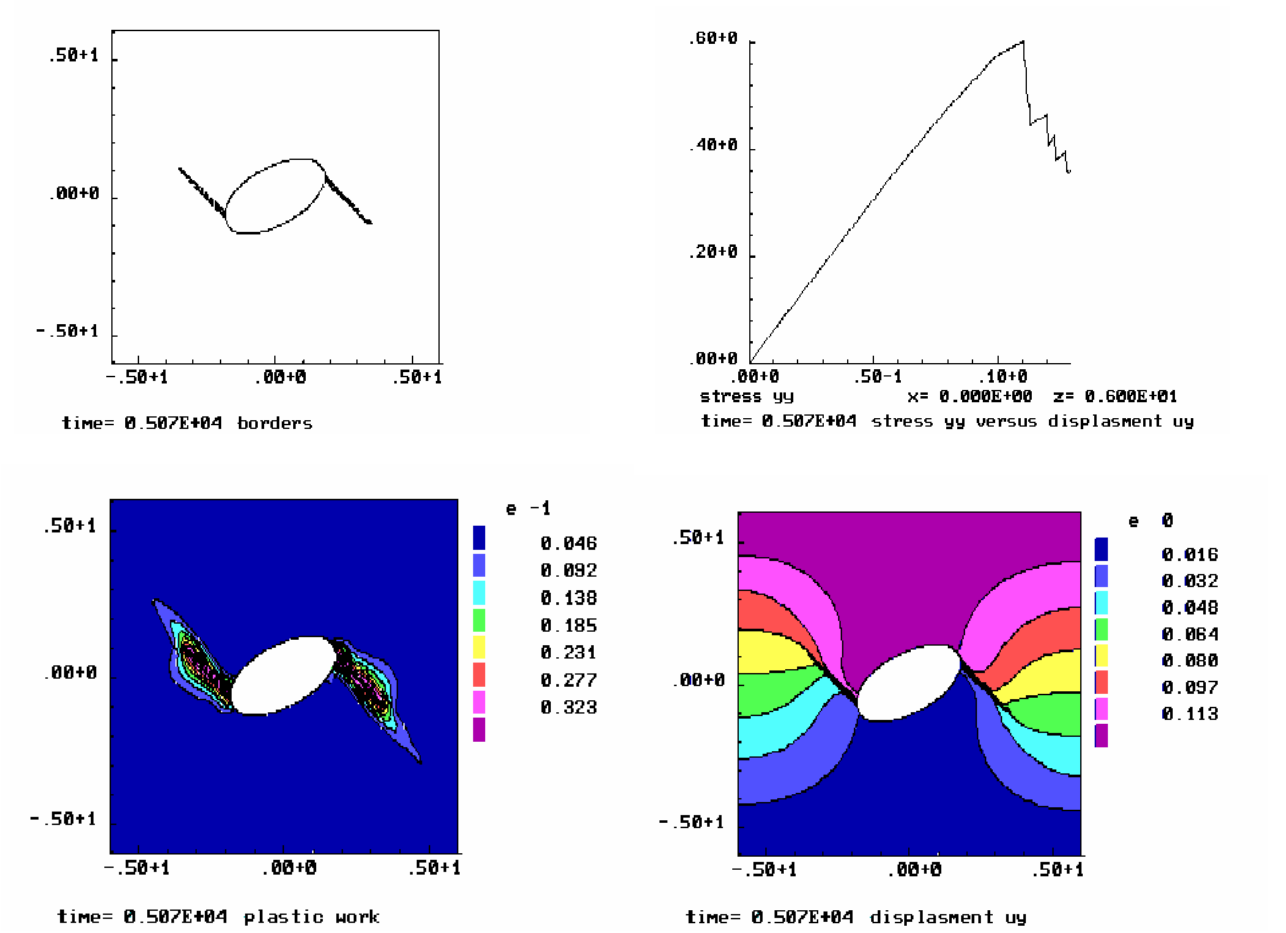

Fig. 3. Case extended plate with big elliptic pore rotated by 30°. The damage zones (upper-left figure), calculated stress-strain diagram (upper-right figure), plastic work (lower-left figure) and verical displacement (lower-right figure) are demonstrated.

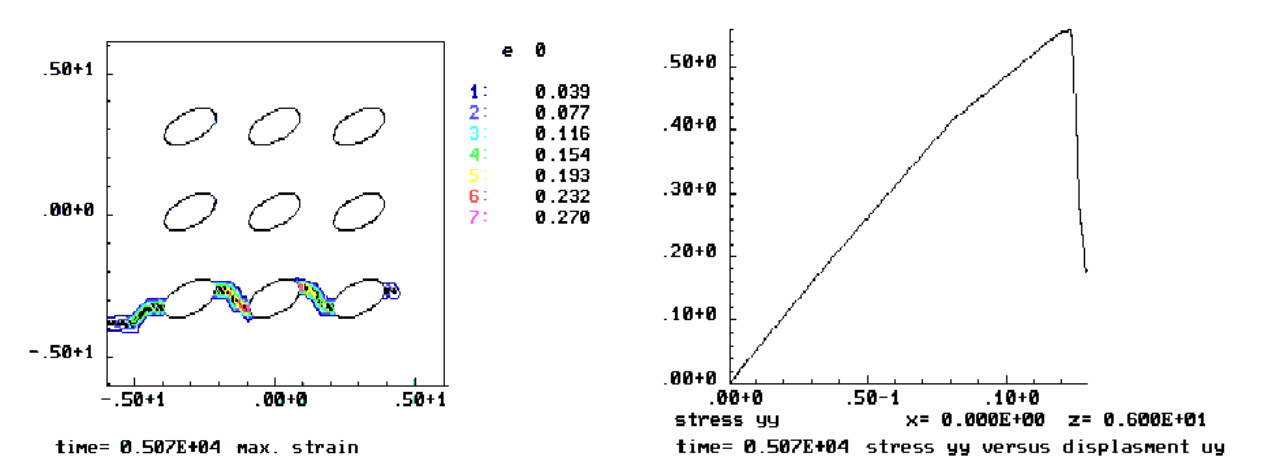

Рис. 4. Extended plate with group og big elliptic pores rotated by 30°. The damage zones (on the left) and calculated stress-strain diagram (on the right) are demonstrated.

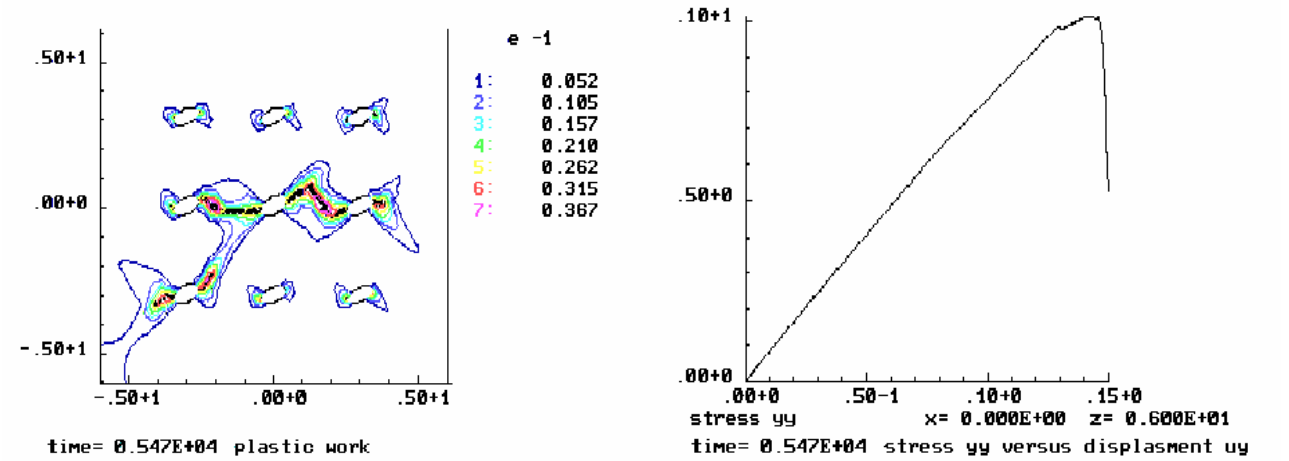

Рис. 5. Extended plate with group of small elliptic pores rotated by 30^{o}. The damage zones (on the left) and calculated stress-strain diagram (on the right) are demonstrated.

In computational models of damage theory we have used: а)isotropic elasticity, associated flow rule и and Garson's plastic criterion, б)the damage criterion in terms of maximal principal strain and linear constant rate kinetyics for damage, в)linear law for elasticity degradation with growth of damage.

The detailed description is presented in [1-9].

References

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