8th World Congress on Computational Mechanics (WCCM8)
5th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS 2008)
June 30 – July 5, 2008
Venice, Italy

COMPUTATIONAL SIMULATION OF IRREVERSIBLE DEFORMING, MICRO- AND MACROFRACTURE OF ROCK IN THE VICINITY OF A BOREHOLE IN ITS DYNAMICAL UNLOADING

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Key Words: *Computational Modelling, Dynamical Deforming, Damage, Fracture.*

ABSTRACT

The rock formation at a depth of several thousands meters is exposed to a hydrostatic pressure. Drilling a borehole makes the drill experience same pressure from the walls of the borehole. On fast removing of the drill from the borehole the dynamical process of unloading borehole walls begins. The sharp decrease of normal pressure on the walls of the borehole brings to the increase of ring stresses. The waves of unloading propagate from the borehole, which could cause fragmentation of rock and blocking the borehole with fractured material. The goal of the present chapter is to give the problem statement for the dynamical process of unloading the internal walls of the borehole after removing the drill, and successive oil-bearing layer's fracturing. The layer is represented by the model of damageable thermoelastoplastic material with two parameters of damaging (by evolution of micropores and by shear microfracturing)[1, 2]. The criterion of the destruction beginning (that is appearence of new free surfaces within the material) uses the principle of critical value of specific dissipated energy[1].

The problem is treated as two-dimensional (plane deformed state). This task is solved by numerical modeling on Lagrangian mesh by method similar to M.L. Wilkins one and on local reconstruction of the Lagrangean grid in the vicinity of the fracture origination[3, 4].

Russian Foundation for Basic Research (grants No. 06-01-00185 and No. 05-08-01435) and ISTC (grant No. 2992) are acknowledged for financial support.

REFERENCES

[1] A.B. Kiselev, "Mathematical modeling of dynamical deformation and combined microfracture of a thermoelastoviscoplastic medium", *Moscow Univ. Mech. Bull.,* Vol. **53**,

No. 6, pp. 32-40, (1998).

[2] A.B. Kiselev, A.A. Lukyanov and M. Thiercelin, "Numerical simulation of dynamic propagation of curvilinear cracks of hydraulic fracturing", *Moscow Univ. Mech. Bull*., Vol. **59**, No. 1, pp. 36-41, (2004).

[3] V.M. Fomin, A.I. Gulidov, A.B. Kiselev, et al., *High-speed interaction of bodies,* Novosibirsk, Sibirian Branch of RAS, 1999.

[4] A.B. Kiselev, "A method for constructing calculation meshes in two-dimensional regions with separation of interior contact interfaces", *GiD 2004, 2nd Conference on Advances and Applications of GiD,* Barcelona, Cimne, pp. 81-84, (2004).