The influence of the plastic properties of the rock on the occurrence of fracturing

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The theory of the propagation of cracks in soils is of great practical importance in modeling the processes occurring in rocks under the influence of various load systems. One of the tasks of this kind is the problem of initiation and propagation of cracks during hydraulic fracturing. This task is important for the oil and gas industry, and the development of computer technology allows you to create more sophisticated fracturing simulators based on the equations of continuum mechanics.

A large number of modern works shows that in order to accurately simulate the propagation of cracks in rock, the equations obtained solely within the framework of the elastic deformation mode are not enough and it is very important to consider the effect of plasticity on the processes of deformation of the medium. When applied to hydraulic fracturing, the ductility that occurs near the tip of the crack provides significant changes in tensile strength.

One of the first proposed conditions for the strength of materials is the Coulomb-Mohr condition. The main advantage of this criterion is comparative simplicity. The next important generalization of this strength model was the Drucker-Prager model, formulated within the framework of the associated law of flow. Later, V.N.Nikolaevsky proposed a model using the non-associated flow law.

In this paper, the effect of the elastoplastic properties of geological material on the development of fracture fracture is considered. The results of this study are tested on data obtained from laboratory experiments on the development of fractures. The material of the samples is taken as the geological material for which all elastic-plastic properties were measured previously. Knowledge of all the properties of the material and the conditions of the experiments allows for almost complete numerical simulation of these experiments. The main result of the work is to determine the influence of the elastic-plastic properties on the initiation of fracture and the comparison of theoretical expectations with real data.