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VIII ВСЕРОССИЙСКАЯ НАУЧНО-ПРАКТИЧЕСКАЯ КОНФЕРЕНЦИЯ С МЕЖДУНАРОДНЫМ УЧАСТИЕМ, ПОСВЯЩЕННАЯ 50-ЛЕТИЮ ОСНОВАНИЯ ИНСТИТУТА ХИМИИ НЕФТИ

«Добыча, подготовка, транспорт нефти и газа»

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NUMERICAL ANALYSIS OF FRACTURE INITIATION AND PROPAGATION IN WEAK POROUS SANDSTONES UNDER MULTIAXIAL COMPRESSION

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Rocks in their natural bedding are most often in a compressed state and don't lose the structural integrity until the occurrence of tensile stresses. Several studies of the mechanical behavior of rocks under the action of tensile stresses have been performed recently utilizing indirect tensile tests, e.g SCB (Semi-Circular Bend test) by Wang et al. (2019), CCNBD (Crack Chevron Notched Brazilian Disc test) by He and Hayatdavoudi (2018), three-point bending test by Vavro et al. (2017).

A large role has also become given to numerical simulation, which expands the understanding of mechanical behavior of rocks subjected to different loading conditions Stefanov (2008); Wang et al. (2019).

Sandstone is one of the most studied rocks. This is due to the fact that sandstone is often found in various engineering fields. Thus, study of mechanisms of sandstone failure, and generally, rocks failure is of a great importance for solving particular engineering problems. Indirect experimental techniques on determination of tensile strength give a good insight into the failure mechanisms. We utilized the Finite-difference method-based approach in order to simulate the deformation and failure of sandstone specimens. Numerical simulation is carried out in 2D plain strain and 3D formulations. Comprehensive formulation of applied method as well as basic equations of solid mechanics could be found in Wilkins (1999). The model includes equations for yield envelope, damage accumulation kinetics and fracture criterion. All model parameters are physical material constants, except the parameter t^*, which is chosen in order to fit the experimental data. Yield envelope is based on the modified Drucker and Prager (1952) model. Modification is related to the utilization of non-associated flow rule and dependence of materials strength constants on accumulated damage. Material is fractured if damage parameter D is equal to 1.

The most common two types of boundary conditions in numerical simulation are uniaxial loading with restricted sliding and free sliding on the surface of load application. Experimental loading conditions lie between these two types of loading, thus, we performed simulation with two types of boundary conditions.

Obtained results are in a satisfactory agreement with experimental observations reported elsewhere (Farrokhrouz and Asef (2017)).

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