NUMERICAL SIMULATION OF LOCAL FIELD CONCENTRATION NEAR THE CONTOUR OF A FRACTURE

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The purpose of the talk is to present accurate, stable and robust methods of stress evaluation at areas of strong field concentration in a vicinity of a propagating front of a hydraulic fracture. Natural inhomogeneities in rocks, such as inclusions, pores, faults, etc., are to be taken into account. We consider both 2D and 3D problems. To reach the goal we suggest using: (i) hypersingular boundary integral equations specially tailored to account for displacement discontinuities on surfaces of fractures, microcracks and contacts of structural elements; (ii) higher order approximations of boundaries and density functions; (iii) special singular, (multi-) wedge elements in 2D and special trapezoidal (triangular, rectangular) edge elements in 3D; (iv) analytical recurrent formulae for all integrals employing mentioned approximations.

In 2D problems the calculations are performed using the advantages of complex variables. In 3D problems, in the case of square-root asymptotics, we suggest a highly efficient and accurate, unified analytical method for evaluation of all influence coefficients.

Emphasize, that these methods provide accurate evaluation of stress intensity factors (SIFs). This is of significance for explicit accounting for the strength of a material, evaluation of safety factors (using the theory of extreme values), modeling the propagation of a fracture front and accompanying seismicity, etc.

The results of numerical experiments highlight the efficiency of the methods developed.