

Thermo-hydro-mechanical analysis in the vicinity of tunnel excavation

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In deep radioactive waste repositories, special attention is paid to the excavation damage zone, which is formed during excavation in the vicinity of the tunnel. This is because high requirements are placed on the repository's impermeability [1]. This paper focuses on the coupled problems of heat transport-mechanics and heat and moisture transport-mechanics. These coupled problems are solved within the framework of a single disposal borehole [2]. Given the very long time scale under study (tens of thousands of years), simpler axially symmetric models are used initially. A three-dimensional numerical model is used to provide a more detailed and accurate description of the disposal boreholes.

Time integration is based on a generalized trapezoidal rule with an adaptive step size to achieve extremely short time steps. The finite element meshes contain hundreds of thousands of degrees of freedom and sometimes as many as millions of finite elements. Special attention is given to solving systems of algebraic equations. Both direct and iterative methods are used, particularly sparse direct solvers and, where possible, the conjugate gradient method. The results are compared.

Acknowledgement: The financial support provided by the GAČR grant No. 26-20457S is gratefully acknowledged.

References

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