

A rigorous variant of the shear strength reduction method and its geotechnical applications

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ABSTRACT

This contribution is focused on a rigorous variant of the shear strength reduction method (SSR) and the corresponding determination of safety factors. It summarizes results presented in [1] and is inspired by [2]. The SSR-based safety factor is proposed to be defined as a solution of an optimization problem that is independent of the plastic flow rule and the space discretization. In case of nonassociative plasticity, a modified Davis approach is used. The optimization problem is analyzed and the corresponding duality between the static and kinematic principles is derived. For numerical solution, a regularization method is introduced and a relation between the original and regularized problems is derived. The regularization method is combined with the finite element method, mesh adaptivity and a damped Newton method. In-house codes in Matlab are used for implementation of this solution concept. Two slope stability problems are considered, one of which follows from analysis of a real slope. Software Plaxis and Comsol Multiphysics are used for comparison of the results. We also discuss uncertainty treatment and an influence of the porous flow.

REFERENCES

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- [2] Tschuchnigg, F., Schweiger, H.F. and Sloan, S.W.. Slope stability analysis by means of finite element limit analysis and finite element strength reduction techniques. Part I: Numerical studies considering non-associated plasticity. *Computers and Geotechnics*, 70 (2015) 169-177.