

INVITATION TO THE LECTURE

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12:30

ROOM 213

ADVANCED CONTINUATION AND ITERATIVE METHODS FOR SLOPE STABILITY ANALYSIS IN 3D

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This lecture deals with the solution of slope stability problems in 3D using the finite element method (FEM) and incremental techniques, including shear strength reduction (SSR) or limit load (LL) methods. The aim is to reliably determine the factor of safety (FoS) of the slope and detect possible slip zones. We build on the Mohr-Coulomb perfectly plastic model, Davis modifications of non-associated plastic flow, and recent mathematical results that connect the determination of FoS with optimization problems. To make the SSR and LL methods more accessible to a mathematical audience, they are also presented in algebraic form and completed with appropriate assumptions enabling numerical analysis. Then, the proposed numerical methods are presented in detail. They are a combination of continuation techniques, Newton-type methods, and deflated Krylov methods with preconditioning. Furthermore, we propose a methodology reducing the overestimation of FoS caused by spatial discretization. It is based on a combination of the continuation techniques with FEM mesh adaptivity. The proposed algorithms are implemented within publicly available Matlab codes and used to investigate the stability of slopes in 3D. Numerical examples also show that the use of deflated Krylov methods leads to a significant acceleration of the calculation. The commercial software Comsol Multiphysics is used to compare the numerical results. The presented results are a joint effort with Michal Běreš, Simona Běrešová, Tomáš Lubér, Zdeněk Michalec, Jaroslav Haslinger and Jakub Kružík.