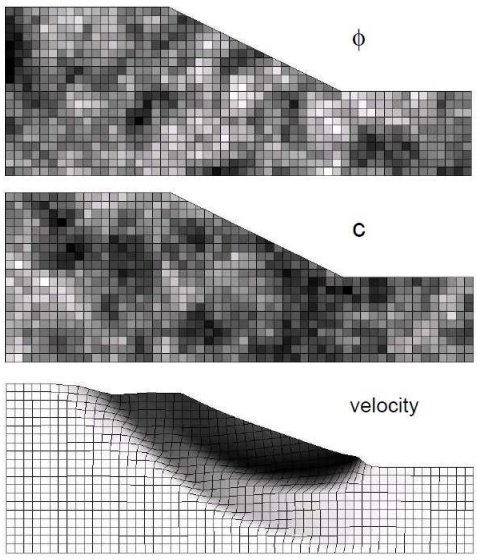
RESEARCH PROJECT GACR

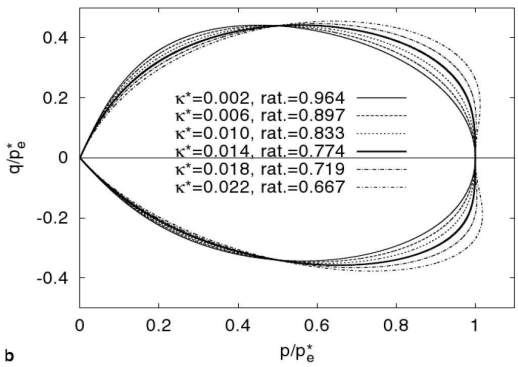
DEVELOPMENT OF ADVANCED NUMERICAL METHODS FOR GEOMATERIALS

Project designation:	**P105/12/1705**
Supplier:	**Grant Agency of the Czech Republic (GACR)**
Period:	**2012 – 2014**
Recipient (leader):	**Charles University in Prague (RNDr. David Mašín, M.Phil., Ph.D.)**
Co-recipient (co-leader):	**3G Consulting Engineers s.r.o. (doc. Ing. Matouš Hilar, Ph.D.)**

Project description:

Constitutive (material) models form the most important (and often most problematic) part of any numerical simulation of geomechanical problems. Correctness of predictions depends primarily on accuracy of description of the geomaterial behaviour. Modelling the soil and rock behaviour is, however, far from being simple. First due to its inherent natural variability, and second due to the state-dependency (porosity, stress, previous loading history) and non-linearity (stiffness variation with loading) of its behaviour. The aim of this research project is a further development of advanced constitutive models for geomaterials based on a particular class of constitutive models (hypoplasticity), their evaluation with respect to numerous monitoring results and their application within more advanced numerical methods considering uncertainties in material parameters. Since the development of the hypoplastic model for clays, the model has been evaluated with respect to different boundary value problems. It was found that the hypoplastic model gives much more accurate predictions than the other constitutive models for soils. However, several shortcomings were identified. Particularly, it was found that the model does not capture properly horizontal displacements in the vicinity of the tunnel. This discrepancy has been attributed to the fact that the model does not consider anisotropy of soil behaviour. The modification of the hypoplastic model to predict correctly the anisotropic soil properties is the first aim of this research project. The model will then be implemented into finite element programs Plaxis 2D and Plaxis 3D. Then, existing and new case histories of tunneling and ground excavations in fine grained soils will be simulated to evaluate the predictive capabilities of the new model. As the third task, the new model, as well as other existing constitutive models, will be utilized within advanced probabilistic analyses of geotechnical problems. The methods considering spatial variability of soil properties based on random field theory will be used. The spatial correlation of parameters and/or state variables will be studied by means of detailed site investigation. Publishing of monography on hypoplasticity is the last task of the research project.





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This research project is a continuation of the previous project GACR 205/08/0732 "The development and evaluation of numerical methods for prediction of the behaviour of tunnels in fine-grained soils" (2007-2010).