

Implementation of a Modified Anisotropic Creep Model for Clays with Use of the Physics Builder

M. Karlsson¹, J. Yannie¹

¹Chalmers University of Technology, Gothenburg, Sweden

Abstract

In this paper a modified anisotropic creep model including structure for clays is implemented in COMSOL Multiphysics® software and is validated against different laboratory tests such as Constant Rate of Strain (CRS) and K₀-consolidated undrained tri-axial tests in both compression and extension.

The implementation in COMSOL is conducted by using a fully coupled analysis between the Solid Mechanics and Darcy Law physics together with the user defined constitutive model (UDCM) created in the Physics Builder. The main part of the UDCM consists of a rotation law that determines the anisotropic behavior of the model, the structure in the soil and both the rate multiplier and creep potential surface. In the Solid Mechanics physics the UDCM is coupled by using the rate multiplier and creep (plastic) potential given in the creep sub-node for a potential material model. The Physics Builder gives the possibility to create constitutive models with a huge number of complex equations together with a graphical user interface and without the need of external programming.

The implemented constitutive model is able to capture both the rate dependency, the anisotropy and the structure observed in soft soils such as clays. The figures show the constitutive model in stress space and p' - q space and will be further explained in the full paper.

Figures used in the abstract

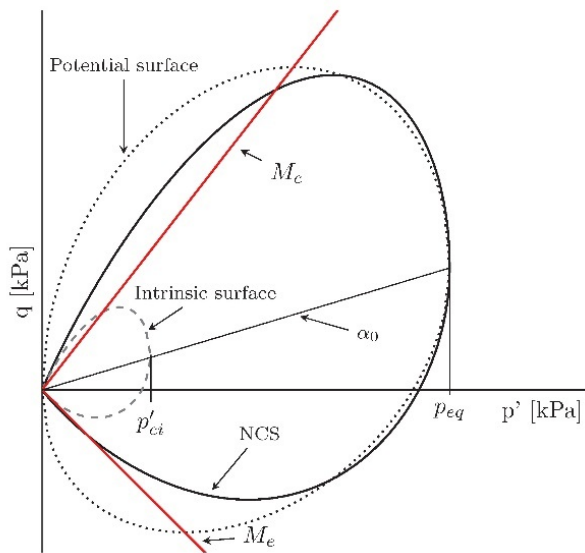


Figure 5: Visualisation of the NCS (solid line) of the MAC-s model with $m=0.4$ compared with plastic potential surface (dotted line) in p' - q stress space together with the intrinsic surface, the failure criteria and the α_0 - line.

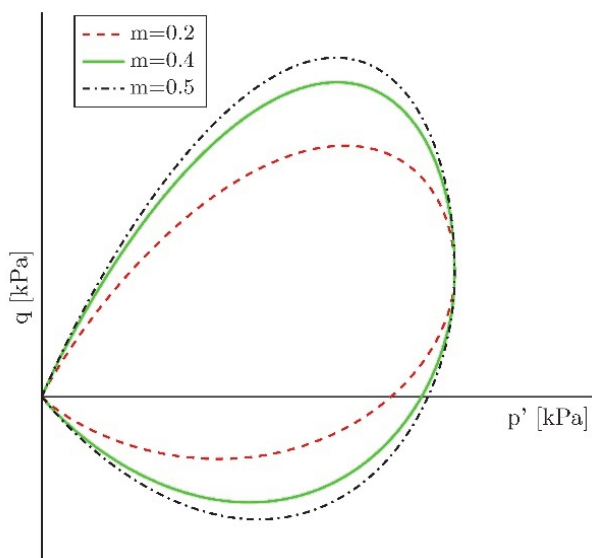


Figure 6: Visualisation of the effect of different m values are shown in p' - q stress space.