

ADVANCED COMPUTATIONAL APPROACHES FOR SOLVING COUPLED PROBLEMS IN GEOMECHANICS

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ABSTRACT

Coupled flow deformation analysis in saturated and unsaturated porous media is an important and challenging topic in many geophysics, engineering applications and industrial processes. Examples include, but are not limited to, rainfall-induced slope failure and landslides, gravity-driven flows, failure of earth dam structures due to internal seepage erosion or overtopping flows during intensive rainfall and flooding events, oil and gas extraction or carbon dioxide sequestration in geological formations. Tackling these challenging problems requires accurate mathematical descriptions of phase interactions (solid, air and water) and phase transformations (evaporation, freezing, fluidisation) together with robust computational frameworks capable of handling highly nonlinear problems. The past few decades have witnessed increasing developments of advanced computational methods and mathematical models to describe the complex coupled problems in geomechanics. Various mathematical models (i.e. governing equations and constitutive models) have been proposed in the literature and successfully shown to be capable of describing complex phase interactions and phase transformations in the porous media. In parallel with the advances in mathematical models, advanced computational methods have also been developed to tackle boundary value applications. While the standard finite element method (FEM) has been proven to be an accurate numerical tool for solving such problems, recent developments of novel particle-based computational methods have also shown their promising potentials in tackling coupled multiphysics problems involving both failures and flow for field-scale geomechanics applications.

The key objective of this Invited Session (IS) is to provide a forum for promotions and exchanges of ideas related to the latest developments and applications of advanced mathematical models and novel computational tools for solving complex coupled problems in geomechanics and related disciplines.