Foreword

The environment of a geomaterial (soil, rock, concrete) determines its susceptibility to failure: grain size distribution and mineralogy, fluid-saturation, pore fluid chemistry, current state of stress, history, the actual loading conditions, rate of deformation, temperature, and other factors. Depending on the type of material and the environment to which it is exposed, failure can take different forms and occur at different times and scales in the loading history.

This special issue provides a forum for presenting the state-of-the-art in computational failure mechanics for geomaterials. The scope of this issue includes: experimental methods needed to develop and validate predictive failure models for geomaterials, theoretical constitutive models needed to mathematically represent the failure processes, computational and multiscale methods needed to robustly and efficiently solve the resulting governing equations, and application of the models to real boundary-value problems.

By design, the topics included in the volume have been selected to represent a wide range of failure analysis scenarios. Aspects considered include: quasi-static and dynamic loading conditions, diffuse and localized failure modes, one-, two-, and three-phase formulations, discrete and continuum modeling, deterministic and statistical calculations, weak and strong discontinuity, deformation band and fracture failure modes, and infinitesimal and finite deformation modeling. Material models significantly impact the mathematical capture of the various failure modes, and thus a host of different regularization techniques also have been presented and utilized to render the boundary-value problem well posed. Finally, whereas the finite element method has been used by most of the authors, finite difference, discrete modeling, meshless methods, and combinations of the aforementioned techniques also have been pursued.

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