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COUPLED MULTIPHYSICS IN POROUS MATERIALS

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ABSTRACT

Porous materials are found in a wide range of engineering applications, including civil engineering, mechanical engineering, and bioengineering to name few. They consist of a deformable porous solid skeleton and one or more fluids occupying the pore space. Several continuum theoretical frameworks have been widely used to describe coupled multiphysics processes in these materials. However, under certain environmental or engineered conditions, advanced modelling approaches, including plasticity and fracture, become necessary. Processes such as ice lens formation, salt crystallization, hydraulic fracturing, and damage localization in porous material can lead to the initiation and propagation of discontinuities within an initially continuous porous medium. These phenomena involve strong localization effects and pose major challenges for both theoretical understanding and computational modeling. This MS aims to bring together researchers working on theoretical and computational aspects of coupled multiphysics processes in porous materials with evolving discontinuities. Topics of interest include multiphysics fracture initiation and propagation, phase change, localization phenomena, and coupled hydro-mechanical, thermo-hydro-mechanical, and chemo-mechanical processes, validation of coupled process as well as multiscale approaches. The MS particularly welcomes contributions on topics, including, but not limited to:

- multi-scale modeling of porous media
- phase-field models for fracture and phase change
- interface formulations
- material point methods, and other novel numerical approaches.
- inverse design of porous metamaterials
- recent techniques applied to study porous media coupled behaviors, such as physics-guided neural networks.