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Fully-coupled hydro-mechanical analysis of water saturated porous geomaterials under complex loading conditions

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ABSTRACT

In this study, we integrate a novel stabilized enhanced strain mixed finite element procedure for poromechanics with an elasto-plastic geomodel to simulate the hydro-mechanical responses of water saturated porous geomaterials such as porous rocks and sands. We present a quantitative analysis on how macroscopic plastic response affects the seepage of pore fluid, and vice versa. We are particular interested in hydromechanical coupling effects on the shear failure behavior of the porous geomaterials as well as its potential regularization effects on pathological mesh dependence. Finite element simulations of shear failure problems of water-saturated porous geomaterials will be presented to study the effect of pore pressure diffusion on the stress path and plastic response of the porous geomaterials.