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Simulation of hydraulic failure in the framework of the Theory of Porous Media

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Considering soil as a fluid-saturated skeleton, the application of the Theory of Porous Media is a convenient tool to model geomechanical flow problems. The Theory of Porous Media itself can be described as the mixture theory enlarged by the concept of volume fractions. It is widely used for bio- and geomechanical simulations treating porous media with a solid phase and at least one fluid phase, compare [1], [2], [3] and [4].

In geomechanical problems, the covered time span is a strong point of interest, as it can range from microseconds (damping, failure) to years (final consolidation) which makes a fixed time step simulation unreasonable in many occasions. That is why one focus of this work is the choice and treatment of the correct time integration scheme in which the implicit Euler, the Houbolt, and the explicit singly diagonally implicit Runge-Kutta methods are only a few possible alternatives.

As the failure of soil is often connected to a loss of solid material via erosion, a mass transport of dissolved particles from the solid to the fluid phase can simulate this behavior keeping the overall mass of the examined body and transferring solid mass to fluid mass following a fluid-solid-difference-velocity driven control formulation. Using the standard Galerkin method this work tries to depict several different approaches of the Theory of Porous Media considering dynamics effects, see [5] and [6].

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