2nd FRASCAL Virtual Colloquium

Modeling coupled damage processes in porous media across the scales

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Material properties and damage evolution in engineering structures are controlled by coupled multifield processes on various length and time scales that might ultimately result in the collapse of the entire structure. Often, such deterioration processes are driven by transport of a liquid phase or further mobile species such as Chloride ions in concrete through pore networks or along highly conductive fractures embedded in a solid phase.

We will discuss (i) concepts for 3D-imaging of coupled transport and crack propagation processes over time using X-Ray Computed Tomography with in-situ testing. (ii) We will present concepts to model coupled degradation processes in porous media. Hereby, we will address crack initiation and propagation under freezing-thawing cycles as well as evaporation-induced desiccation cracking. Hence, we will introduce a micromorphic phase-field model to describe crack initiation and propagation where the conventional energy functional pertaining to the linear elastic single phase media is extended towards two-phase (partially) saturated porous media. The micromorphic model retains the phase-field fracture length-scale, however, with a new variable for regularization. The phase-field is, therefore, transformed into a local quantity (evaluated at integration points), which enables fracture irreversibility enforcement with system-level precision.

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