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FROM FREEZING-INDUCED TO INJECTION-INDUCED NON-ISOTHERMAL SATURATED POROUS MEDIA FRACTURE

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The focus in this presentation is laid on different aspects and instances related to porous media fracture under non-isothermal conditions. This includes the extreme case of fracturing due to pore-fluid freezing, where the micro-cryo-suction plays an important role in generating the required stresses for crack onset. This also includes studying the effect of the pore-fluid temperature and the ambient temperature on the pressure needed to initiate the crack. In all cases, the continuum mechanical modeling of the induced fractures is based on macroscopic porous media mechanics together with the phase-field method (PFM) for fracture modeling. For the micro-cryo-suction in saturated porous media, the water freezing is treated as a phase-change process. This is modeled using a different phase-field approach, in which the thermal energy derives the phase change and, thus, leads to the occurrence of micro-cryo-suction.

Several numerical examples will be presented and include qualitative and quantitative comparisons with experimental data. Besides, an overview of recent advancements in related multiscale porous media modeling will be presented. This will focus on the possible inclusion of machine learning to replace conventional material models for the THM process using, e.g., deep recurrent neural networks (RNN).

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