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Capillary-condensation-induced stress in complex multi-scale porous materials

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Capillary condensation in a nano-porous material can induce high local stresses affecting its transport, tribological and rheological properties, promoting cracking and can eventually lead to failure of the material.
However it is a non-trivial problem to determine the capillary stress field in realistic 3D structures covering the entire range of degree of liquid saturation.
We propose a general and quantitative numerical framework to address the chemo-poro-mechanics in realistic complex pore networks arising from liquid stresses at all range of relative humidities, exemplified with a mesoscale model of cement.
We discuss the microscopic irreversibility observed in our simulations and its implications on cement drying shrinkage

References

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