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Deforming unsaturated media: a unified approach

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The finite deformation of an unsaturated porous medium is the result of a complex interplay between capillary effects, interfacial area propagation, pressure diffusion and large deformations of the solid skeleton. Discrete approaches provide a means to integrate the physics of capillarity with deformation. However, discrete approaches only open the road to simple cases. The authors analysed the interplay of deformation and capillarity in a continuum thermodynamic analysis [1]. An expression for Bishop's effective stress directly links to the deformation dependent Brooks and Corey's water retention curve by the restrictions on the constitutive relationships of an unsaturated medium. The resulting expression for the effective stress parameter is reasonably consistent with experimental data from the literature. In the present presentation, the authors will attempt to include interfacial area as an independent variable to create a model that predicts the hysteresis observed in drainage-imbibition and in stress-strain relationships.

References

[1] Huyghe J.M., E. Nikoosaei, S.M. Hassanizadeh. A thermodynamical analysis of deforming unsaturated media. *Transport in Porous Media* 117: 349–365

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