Seminar Announcement

September 28, 2018 – h. 12:00

Aula Catullo – Dipartimento di Geoscienze

A New Generation of Models to Describe Two-Fluid Flow in Porous Medium Systems

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Two-fluid flow through porous medium systems occurs routinely in natural, engineered, and biological systems. While fundamental understanding is most advanced at the microscale, in order to model many systems of concern at the desired length scale, macroscale models are needed. Traditional averaging approaches have several drawbacks, including a lack of connection between scales, explicit omission of important variables, and hysteretic closure. To respond to these theoretical issues, we have developed the thermodynamically constrained averaging theory (TCAT), which can be applied to derive macroscale models. A TCAT hierarchy of models has been derived to describe two-fluid flow, which resolves the open issues associated with traditional approaches. Recent results are reported that illustrate evaluation, verification, and validation of certain aspects of these novel models. These results include an illustration of the importance of the rate of relaxation to an equilibrium state; the formulation of a new non-hysteretic state equation for capillary pressure, which is formulated by extending fundamental ideas from integral topology; and recent results from differential geometry that provide evolution equations for geometric extent measures and interfacial curvatures, which are shown to be necessary for high-fidelity models.