

ANALYSIS OF CAPILLARY PRESSURE IN A TWO-FLUID-PHASE POROUS MEDIUM SYSTEM

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Modeling two-fluid-phase flow in porous medium systems requires the specification of closure relations to produce a solvable system. The thermodynamically constrained averaging theory (TCAT) has been used to formulate a closed model and to yield insights about the underlying microscale processes that must be represented at the macroscale. To support these TCAT developments, we consider two-fluid-phase flow micro-model experiments. Image analysis is used to interpret the fluid distributions, interfacial areas, and curvatures from a laboratory experiment in which external fluid pressures were varied and the system allowed to equilibrate for a period of time before the next step change in fluid pressures. The equilibrium state is modeled at the pore scale based upon a medial axis analysis. The equilibrium state and dynamics are also simulated using a lattice Boltzmann method. The results are considered in light of model forms and closure relations produced using TCAT.