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Incorporating Bubble Evolution and Transport in Constitutive Relationships for Quasi- and non-Equilibrium two-Phase Flo

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Bubble generation and transport play a role in many subsurface processes. Production and/or mobilization of gas is for instance observed in biogenic production of methane in peats, and in association with leakage from engineered geologic CO2 storage systems. Other subsurface engineered systems include in-situ air sparging in conjunction with soil vapor extraction, and electrical resistance heating. Thus, there is a need to better understand the presence and transport of bubbles in multi-phase subsurface porous media so that that these processes can be accurately described, and more efficient engineered solutions can be developed.
To this end, constitutive relationships between geometric state variables (fluid curvature, Jnw; non-wetting phase volume, Vn; interfacial area, anw; and Euler characteristic, χ_n) have become increasingly more common in efforts to uniquely predict the state of a two-fluid flow system.
Both lattice Boltzman simulations and fast microtomography experiments have shown that a geometric state function using the non-dimensionalized invariant properties of saturation, specific interfacial area, and Euler characteristic can uniquely predict the mean curvature of the system for both quasi- and non-equilibrium conditions, however, the presence of bubble evolution and transport has not been explored. This study investigates whether the geometric state function remains unique with the inclusion of bubble generation and transport under quasi- and non-equilibrium two-fluid flow.

Participation

In-Person

References

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