

Materials for 5th Int. Conference on Applications of Porous Media

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Title: Non-equilibrium models for two phase flow in porous media: the occurrence of saturation overshoots

Abstract:

There are numerous experiments evidencing saturation overshoots for flows in homogeneous porous media. Such phenomena are ruled out by standard mathematical models, which are based on equilibrium assumptions. In this presentation we discuss non-equilibrium models, in particular including dynamic effects in the capillary pressure. This leads to extensions of the classical Buckley-Leverett (BL) equation, a commonly accepted model for two-phase flow in porous media. For this extended equation we investigate the existence of traveling wave solutions. In analogy with the classical theory for hyperbolic conservation laws, we consider the limit case when capillary effects are vanishing, and define admissible shocks for the original BL equation that violate the Oleinik entropy condition. Based on this we explain the occurrence of saturation overshoots, and discuss the profiles obtained under different assumptions (one phase or two phase models, high or low injection rates).