

## **Modeling of two-phase flow in porous media including fluid-fluid interfacial area**

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We present a new numerical model for macro-scale two-phase flow in porous media which is based on a physically consistent theory of multi-phase flow.

The standard approach for modeling the flow of two fluid phases in a porous medium consists of a continuity equation for each phase, an extended form of Darcy's law as well as constitutive relationships for relative permeability and capillary pressure. This approach is known to have a number of important shortcomings and, in particular, it does not account for the presence and role of fluid--fluid interfaces.

The alternative is to use an extended model which is founded on thermodynamic principles and is physically consistent. In addition to the standard equations, the model uses a balance equation for specific interfacial area. The constitutive relationship for capillary pressure involves not only saturation, but also specific interfacial area.

We present results of a numerical modelling study based on this extended model. We show that the extended model can capture additional physical processes compared to the standard model, such as hysteresis.