

Stability of saturation overshoots for twophase flow in porous media

Rainer Helmig¹ Tobias Köppl², Martin Schneider³

¹University Stuttgart, Department of Hydromechanics and Modeling of Hydrosystems, Stuttgart, rainer.helmig@iws.uni-stuttgart.de

²University Stuttgart, Department of Hydromechanics and Modeling of Hydrosystems, Stuttgart, tobias.koeppl@iws.uni-stuttgart.de

³University Stuttgart, Department of Hydromechanics and Modeling of Hydrosystems, Stuttgart, martin.schneider@iws.uni-stuttgart.de

In this talk, we are concerned with the computational analysis of saturation overshoots for twophase flow in porous media. In particular, it is of interest under which conditions a given saturation overshoot remains stable, while moving through a porous medium. In order to investigate this issue, we consider a decoupled and a fully coupled model, where drainage and imbibition processes are incorporated into the models by means of hysteresis models. Using the decoupled model, we estimate in the Buckley-Leverett limit the speed of the drainage and imbibition front. By these speeds, one can determine the stability of a given saturation overshoot. Moreover, they are used to compute an analytical solution for the saturation, which forms a basis for calibrating the coupled twophase flow model with respect to its boundary conditions and hysteresis parameters.

References

- Susanne Fritz (2012): Experimental investigations of water infiltration into unsaturated soil - Analysis of dynamic capillarity effects. Master's thesis– In: Department of Hydromechanics and Modeling of Hydrosystems; Universität Stuttgart.
- Rudolf Hilfer & Rouven Steinle (2014): Saturation overshoot and hysteresis for twophase flow in porous media. – In: The European Physical Journal SpecialTopics, 223(11): 2323-2338.
- Rouven Steinle & Rudolf Hilfer (2016): Influence of initial conditions on propagation, growth and decay of saturation overshoot. – In: Transport in Porous Media, 111:369-380.
- Sabine Manthey & S. Majid Hassanizadeh & Rainer Helmig & Rudolf Hilfer (2008): Dimensional analysis of two-phase flow including a rate-dependent capillary pressure-saturation relationship. – In: Advances in water resources, 31(9):1137-1150.