Benchmarking tailored formulations of multiphase flow in porous media

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Introduction

Nowadays, gas and nuclear waste storage, shale gas and EOR exploitation rise the need to understand and predict the fate of multiphase flows in the underground.

Various formulations for multiphase flow arise from different linear combinations of governing equations and choice of associated unknowns (Chen et al., 2006; Helmig et al., 1997). Each formulation has its own benefits and drawbacks; and the optimal may vary depending on the conceptualization of the problem.

Benchmarking

Buckley & Leverett, 1942

McWhorter & Sunada, 1990

Leakage well (Ebigbo et al., 2007)

Five-spot (Chen, et al., 2006)

References


A set of formulations, available for the selection of the user, have been implemented in COMSOL. The formulations are able to model two-phase, variable density, miscible and immiscible fluid flows in any dimensions.

Currently, the equations of state of oil, water, brine and supercritical CO2 have been implemented although they can be easily extended to any other fluid. These formulations open a wide spectrum of possible applications for multiphase processes that can be combined with other physics to create multiphase multiphysics applications.