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Simultaneous Uncertainty Analysis for SCAL Data Interpretation

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Relative permeability and capillary pressure saturation functions are key uncertainties to characterize multiphase flow in porous media. Therefore, typically a lot of resources are spent on measuring these key functions for various operations. Despite the effort and time, it is not yet common practice to forward simulate or numerically match SCAL data to reliably extract relative permeability and capillary pressure with a realistic estimation of the errors. In this paper, we present a MATLAB-MRST based SCAL interpretation tool for simultaneous history matching and uncertainty analysis of SCAL data sets from different experiments using Markov chain Monte Carlo (MCMC) methods. We focus on the most common and difficult to interpret experimental methods namely steady state and unsteady state relative permeability, and centrifuge capillary pressure experiments. The simulator was benchmarked against a synthetic dataset and applied to a comprehensive SCAL data set of primary drainage in a carbonate rock type. We propose a point-by-point construction of the saturation functions to overcome the limitations of the saturation function parametrizations (e.g., Corey) and deliver a more comprehensive sensitivity and uncertainty analysis. The reliability of the interpretation is assessed by a variation of the experimental samples, and then analyzing how the interpretation of the SCAL datasets fits into the results. Thereby, we attach importance to the uncertainty analysis, which is important for an honest evaluation of the reservoir performance.

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Time Block Preference

Time Block B (14:00-17:00 CET)

Participation

Unsure

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