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Inverse modeling of transient three-dimensional core-scale two-phase flows

Wednesday, 2 June 2021 15:45 (15 minutes)

We consider transient three-dimensional (3D) two-phase (oil and water) flows, taking place at the core-scale. In this context, we aim at exploiting the full information content associated with available information of (i) the 3D distribution of oil saturation and (ii) the overall pressure difference across the rock sample, to estimate the set of model parameters. We consider a continuum-scale description of the system behavior upon relying on the widely employed Brooks-Corey model for the characterization of relative permeabilities and on the capillary pressure correlation introduced by Skjaeveland et al. (2000). To provide a transparent way of assessing the results of the inversion, we rely on a synthetic reference scenario. The latter is intended to mimic having at our disposal 3D and section-averaged distributions of (time-dependent) oil saturations of the kind that can be acquired during typical laboratory experiments. These are in turn corrupted by way of a random noise, to address the influence of experimental uncertainties. We focus on diverse scenarios encompassing imbibition and drainage conditions. We employ two population-based optimization algorithms, i.e., (i) the particle swarm optimization (PSO); and (ii) the differential evolution (DE), which enable one to effectively tackle the high-dimensionality parameters space (i.e., 12 dimensions in our setting) we consider. Model calibration results are of satisfactory quality for the majority of the tested scenarios, whereas the DE algorithm is associated with highest effectiveness.

Time Block Preference

Time Block A (09:00-12:00 CET)

References

S.M. Skjaeveland; L.M. Siqveland; A. Kjosavik; W.L. Hammervold Thomas; G.A. Virnovsky (2000). Capillary Pressure Correlation for Mixed-Wet Reservoirs SPE Res Eval & Eng 3 (01): 60–67. https://doi.org/10.2118/60900-PA

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