Contribution ID: **487** Type: **Oral Presentation**

Towards Unified Pore-Scale Imaging and Modelling: Comparison of the Generalized Network Model with Direct Numerical Simulation

Thursday, 3 June 2021 11:15 (15 minutes)

A thorough understanding of pore-scale modelling techniques is essential to flow through permeable media research. We compare two phase-flow simulations from the generalised network model (GNM) [Raeini et al, 2017, 2018] with a recently developed lattice-Boltzmann model (LBM) [Akai et al, 2018, 2020] for drainage and waterflooding in two samples —a synthetic beadpack and a micro-CT imaged Bentheimer sandstone —for water-wet, mixed-wet and oil-wet states. We further compare the GNM to a volume-of-fluid method [Shams et al. 2018] for two-phase flow in a synthetic two-pore system. An analysis of macroscopic capillary pressure shows a large discrepancy between the GNM and both direct numerical simulations, with volume-of-fluid simulations highlighting the need for accurate pore-space geometry in network modelling. Pore-by-pore comparison between the GNM and LBM reveals a good agreement for oil and water-wet media. The comparison for mixed-wet media, however, shows greater differences. We suggest that the dependence of displacement on wettability in the mixed-wet state is responsible for this discrepancy. Compared to the LBM, the GNM can reach lower initial water saturations and captures the effect of layer flow —a prohibitively expensive task for LBMs —by achieving a lower residual oil saturation after waterflooding in altered wetting states. Overall, we present a workflow for the comparison of porenetwork models with direct numerical simulation of multi-phase flow. We demonstrate their strengths and shortcomings through an analysis of local and macroscopic parameters while showing how high-fidelity approaches can be used to facilitate future network model development.

Time Block Preference

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

References

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Session Classification: MS9

Track Classification: (MS9) Pore-scale modelling