Pore-to-Field Upscaling of Immiscible Two-Phase Flow

Upscaling is a very important subject in reservoir simulation and modelling studies, where heterogeneities captured at the pore level using high-resolution images are usually ignored – as there is no rigorous technique to deal with such small-scale information – or lost due to the use of inappropriate upscaling methods. Moreover, multiphase flow properties obtained by pore-scale modelling, as a stand-alone simulation technique, need to be transformed to larger scales, even under the assumption of having a representative elementary volume (REV), to properly address the impact of fluid forces and flow regimes controlling the displacement process. As a result, new insights could be gained about the impact of different micro-scale properties – e.g., wettability and micro-porosity – on the macro-scale properties of the system. In literature, a few studies have dealt with the upscaling from pore- to field-scale simulation. Most of the methodologies were applicable to single-phase flow only with potential extensions to multiphase flow systems. Hence, we need to develop a methodology to upscale multiphase flow starting from a representative pore-scale model, to field-scale gridblocks subjected to different boundary conditions. Here, a generalized network approach is introduced where pore-scale information is used as a single pair of nodes connected through a link to initialize the generalized network model. A multistage approach is then applied. At each run, each pair of nodes is updated with the multiphase flow information computed from the previous simulation run. This process is repeated until reaching the desired scale.

PRESENTER:
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