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Upscaling of two-phase flow in porous media with free boundary at the pore scale.

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Reactive flows and transport models through the porous medium are important for a wide range of scientific and industrial processes. Examples in this sense are groundwater remediation, oil recovery from reservoirs, CO_2 sequestration etc. The main goal of the research is to develop mathematical models that describe such processes at the pore scale and to derive effective models at the macro (Darcy) scale through analytical upscaling. A particular feature of the models addressed here is the occurrence of freely moving interfaces separating different phases, like fluid-fluid (two-phase/unsaturated flow) or solid-fluid (one-phase flow with dissolution/precipitation) at the pore scale. The focus of the research is to give a rational derivation of the upscaled models, which are not only less complex to describe, but also very efficient to simulate. To this aim, homogenization theory based on asymptotic expansion is applied.

References

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