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MODELING AND SIMULATION OF CAPILLARY IMBIBITION PROCESSES IN POROUS MEDIA

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Abstract. Capillary imbibition is appealing as a technique to drive fluids in a domain, as it can be leveraged to obtain predictable flows that do not require the use of pumps. A promising application of capillary imbibition in porous media lies within the growing field of paper-based microfluidics, which is enabling the development of affordable and autonomous portable devices for use in clinical diagnostics, biomedicine, and the environmental sciences, among other disciplines. Simulations of flows in porous media, including supporting software, have mostly focused on problems at scales that are several orders of magnitude larger, such as models of groundwater systems and oil extraction processes. In this work, we use the *porousMultiphaseFoam* library within the OpenFOAM® simulation platform in order to model and solve cases of capillary imbibition in complex paper structures with applications in biotechnology. The simulation model is validated, in terms of the resulting flow rates and shapes of the wetting fronts, against problems that have established analytical/empirical solutions, before being used to solve complex cases of practical interest.