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A WETTING FRONT GENERATOR FOR THE ASSESSMENT OF CAPILLARITY MODELS

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Abstract. We present a numerical technique and software tool able to predict the continuous saturation field during the capillary imbibition of porous media, under lateral flow assumptions compatible with the most common laboratory setups and analytical devices in paper-based microfluidics. The wetting front generator solves the non-linear Richards equation via repeated numerical integration using a high-order implicit scheme, with support for arbitrary capillary pressure and permeability (capillarity) models. The generator allows for the study and validation of current and new capillarity models in an efficient manner, including the fitting of model parameters to experimental data. Furthermore, we show that the generated wetting fronts may be used to reconstruct a continuous velocity field for the infiltrating liquid. Results obtained using the new tool are compared with the usual Lucas-Washburn approach in a lateral flow case, in terms of flow and transport behaviors.