p-Adaptive discontinuous Galerkin method for Richards' equation solution

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Flows in variably-saturated porous media are described by Richards' equation whose numerical solving can be troublesome and costly because of abrupt changes in the nonlinear hydraulic properties [1]. Typically, Richards' equation exhibits sharp wetting fronts moving dynamically in the unsaturated zone while the saturated zone remains relatively smooth. In that context, local adaptation of mesh discretization (h-adaptation) or space order approximation (p-adaptation) can improve the computational efficiency. This work aims to investigate p-adaptation which is known to reach accuracy with a reduced cost compared to low-order methods [2]. To this end, Richards' equation is solved by discontinuous Galerkin methods [3] whose properties make them appealing for locally adaptive high- order approximation. In this study, the p-adaptative algorithm is kept simple in order to make extension to hp-adaptation as easy as possible in the future. Benefits for Richards' equation are evaluated. Results from numerical experiments demonstrate the potential of p-adaptation for Richards' equation.

References:

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