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A posteriori error estimates for flow modeling using an Enhanced Velocity scheme

A novel and an efficient method, adaptive numerical homogenization, is used for modeling of flow and transport in the heterogeneous porous media [1]. The key component of method is a selection of appropriate adaptivity criteria to achieve better accuracy of simulation. In the flow, the traditional error indicator relies on pressure error indicator, however, most of the previous studies do not take into account velocity error in the adaptivity strategy. The velocity plays important role in the coupling flow and transport problems.
We investigate a posteriori error estimator for the Darcy flow using Enhanced Velocity Mixed FEM [2]. We show the error indicators for pressure error and velocity error. Residual-based error indicator and implicit error indicator will be derived theoretically and will be demonstrated numerically. In the implicit error analysis, we used the post-processing of pressure from [3] to achieve better indicator of flux. The residual estimators are better indicators for pressure error in the incompressible flow. Moreover, we show the advantages of the implicit error estimators with postprocessing in the detection of velocity error numerically. Numerical experiments are also presented. The proposed indicators can be successfully used for a number of adaptive methods with Enhanced Velocity scheme in subsurface simulations.

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