

An IMFES Formulation for the 2D Three-phase Black-oil Equations

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Abstract

A new approach for solving the PDEs corresponding to the flux equations governing a three-phase black-oil model in a 2D porous media is proposed. The 2D physical domain is meshed using non-rectangular quadrilaterals. The approach for solving the PDEs consists of solving the total flux implicitly and oil, water and gas saturations explicitly. This formulation avoids solving a costly second order differential equation in pressure. In the proposed approach, the total flux is expressed as an asymptotic expansion of ascending powers of the total fluid compressibility. Contributions to the total flux are obtained from solving first order differential equations (gradient and divergence operators). Discretizing these operators by finite volume or finite difference methods, the resulting linear system coefficients are fixed during the whole simulation. Preliminary numerical results are consistent with the physical interpretation in the case of one dimensional scenarios.

References

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