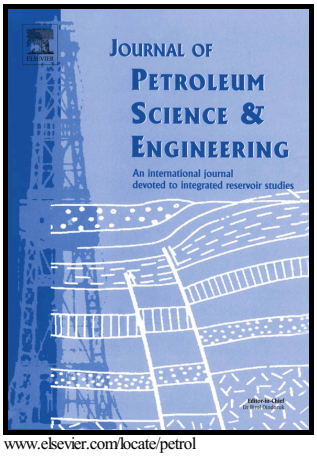

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An Efficient Two-Scale Hybrid Embedded Fracture Model for Shale Gas Simulation

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Abstract
Natural and hydraulic fractures existence and state differs on a reservoir-by-reservoir or even on a well-by-well basis leading to the necessity of exploring the flow regimes variations with respect to the diverse fracture-network shapes forged. Conventional Dual-Porosity Dual-Permeability (DPDP) schemes are not adequate to model such complex fracture-network systems. To overcome this difficulty, in this paper, an iterative Hybrid Embedded multiscale (two-scale) Fracture model (HEF) is applied on a derived fit-for-purpose shale gas model. The HEF model involves splitting the fracture computations into two scales: 1) fine-scale solves for the flux exchange parameter within each grid cell; 2) coarse-scale solves for the pressure applied to the domain grid cells using the flux exchange parameter computed at each grid cell from the fine-scale. After that, the D dimensions matrix pressure and the (D-1) lower dimensional fracture pressure are solved as a system to apply the matrix-fracture coupling. HEF model combines the DPDP overlapping continua concept, the DFN lower dimensional fractures concept, the HFN hierarchical fracture concept, and the CCFD model simplicity. As for the fit-for-purpose shale gas model, various fit-for-purpose shale gas models can be derived using any set of selected properties plugged in one of the most popularly used proposed literature models as shown in the appendix. Also, this paper shows that shale extreme low permeability cause flow behavior to be dominated by the structure and magnitude of high permeability fractures.
Keywords: Shale Gas, CCFD, DPDP, two-scale, fracture network, hybrid fracture method.

1 Introduction

Rocks are aggregates of minerals and cavities mixtures. Cavities include fractures and pores. Analyzing the extent to which hydrocarbons including oil and shale gas are trapped in a formation and whether those hydrocarbons can be removed from rock cavities and produced or not has to begin with an analysis of the rocks themselves. The properties of interest are often controlled more by the rock fabric than by the bulk composition. Cavities ability to contain hydrocarbons is usually more