Modeling of oil transport in porous media using multiscale method with adaptive mesh refinement

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Abstract

The porous media of oil reservoirs have different layers with wide range scales which are different in effective scale of fluid flow. To reduce the calculating time of porous reservoirs modeling, each physical effect should be treated separately on its scale and area of influence. It is proposed that, the fluid transport and deformation of solid part of porous media are determined through separate frameworks. The fluid flow equations are solved using multiscale finite volume methods. The finite element method is used for solving the solid equilibriums. The available mesh dimensions is refined for different areas of solid media in each iteration of the analysis, according to the density of data and results. The interactions between solid deformation and multiscale multiphase flow frameworks are instated through iterative coupling. Also, the linear elastic relationship is considered between stress and strain of solid part and the capillary pressures parameters between fluid phases are added on fluid flow equations to increase the accuracy of modeling. Finally, indicative test cases are analyzed and reasonable results are achieved.