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Two-Dimensional Observation of Oil Displacement by Water in a Petroleum Reservoir through Numerical Simulation and Application to a Petroleum Reservoir

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Abstract : We examine two-dimensional oil displacement by water in a petroleum reservoir. The pore fluid is immiscible, and the porous media is homogenous and isotropic in the horizontal direction. Buckley-Leverett theory and a combination of Laplacian and Darcy’s law are used to study the fluid flow through porous media, and the Laplacian that defines the dispersion and diffusion of fluid in the sand using heavy oil is discussed. The reservoir is homogenous in the horizontal direction, as expressed by the partial differential equation. Two main factors which are observed are the water saturation and pressure distribution in the reservoir, and they are evaluated for predicting oil recovery in two dimensions by a physical and mathematical simulation model. We review the numerical simulation that solves difficult partial differential reservoir equations. Based on the numerical simulations, the saturation and pressure equations are calculated by the iterative alternating direction implicit method and the iterative alternating direction explicit method, respectively, according to the finite difference assumption. However, to understand the displacement of oil by water and the amount of water dispersion in the reservoir better, an interpolated contour line of the water distribution of the five-spot pattern, that provides an approximate solution which agrees well with the experimental results, is also presented. Finally, a computer program is developed to calculate the equation for pressure and water saturation and to draw the pressure contour line and water distribution contour line for the reservoir.

Keywords : numerical simulation, immiscible, finite difference, IADI, IDE, waterflooding
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