Numerical Simulation of Oil and Gas Flow in Heterogeneous Reservoirs

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Abstract

The numerical simulation of petroleum resevoirs is widely used as a predictive tool for hydrocarbons production, reserves and dynamic behavior of relevant parameters as: pressures, fluid saturations, water cut and gas production. In spite of advances in computing capacities, there remain challenging tasks in order to improve the accuracy of simulations. For instance we quote up-scaling procedures, history matching, multiphase flow in anisotropic and heterogeneous reservoirs, and, in general, better descriptions of physical laws. These are some issues being investigated currently (Islam et al., 2010). In this work, we focus on the computation of oil, water and gas flowing simultaneously through reservoir rocks having fractures which can be naturally or artificially-induced. Such scenario can be found in carbonate and shale petroleum reservoirs. We state the mass and momentum balance for oil, water and gas leading to three, nonlinear and coupled partial differential equations. Additionally, the phase behavior and fluid-rock properties are written for typical volatile oil. Complementing with the initial and boundary conditions, the mathematical model was numerically solved using Comsol, which is based on finite element procedures. Comparisons with available field data are shown to validate numerical results. The transient behavior of relevant parameters are also presented.

References

1. M.R. Islam and S.H. Moussavizadegan and S. Mustafiz and J.H. Abou-Kassem. Advanced Petroleum Reservoir Simulation. Wiley-Scrivener (2010).