**Sousa, Luara K. S.**; **Cantagesso, Luana C. M.**; **Pires, Adolfo P.**; **Peres, Alvaro M. M.**
**Two-phase three-component flow in porous media: mathematical modeling of dispersion-free pressure behavior.** (English) Zbl 1440.76151
Constanda, Christian (ed.), Computational and analytic methods in science and engineering. Selected papers based on the presentations at the 19th international conference on computational and mathematical methods in science and engineering, CMMSE'19, Rota, Spain, June 30 – July 6, 2019. Cham: Birkhäuser. 223-237 (2020).

Summary: Multiphase multicomponent flow in porous media is modeled by a system of $n_c$ parabolic equations, where $n_c$ is the number of components. Problem unknowns are phase components mass fractions, and pressure and saturation of each phase. Several constitutive relations (phase equilibria, phases relative permeabilities, capillary pressure, etc.), constraint equations (sum of phases saturations, sum of components mass fractions in each phase, etc.), and model parameters (porosity, permeability, diffusion and dispersion coefficients, etc.) are also necessary to close the problem formulation. For the case of advection dominated flow, where second order effects are neglected (gravity, capillarity, dispersion), the problem reduces to a quasilinear system of hyperbolic equations (conservation laws), which can be solved by the method of characteristics. Once the hyperbolic problem is solved, the pressure profile is obtained through the integration of Darcy's law over the spatial domain. This technique is applied to three different problems that commonly arise in petroleum engineering: oil displacement by water, which is the most used technique to improve oil recovery; polymer flooding, a classical method of chemical enhanced oil recovery; and miscible flooding, if the injected fluid exchanges mass with the original oil in porous media. Three one-dimensional problems are solved by the method of characteristics. The solution structure is similar for all cases, and three regions appear: from the injection point a one-phase region develops, followed by a two-phase region, where mass transfer might take place; and the last region shows the single-phase flow of the original fluid in place.

For the entire collection see [Zbl 1446.74005].

**MSC:**

76S05 Flows in porous media; filtration; seepage
76T99 Multiphase and multicomponent flows
76-10 Mathematical modeling or simulation for problems pertaining to fluid mechanics

**Full Text:** DOI

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