

عنوان مقاله:

The Power of Numerical Pressure Transient Analysis for Heterogeneity Characterization

محل انتشار:

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خلاصه مقاله:

We consider the application of the Finite Element Method (FEM) for numerical pressure transient analysis (PTA) under conditions where no reliable analytical solution is available. PTA is normally based on various analytical solutions of the linear one-dimensional diffusion equation under restrictive assumptions about the formation and its boundaries. For example, the formation is either assumed isotropic or a restrictive a priori assumption is made about its heterogeneity. The wellbore storage effect is also often considered without regard to the possibility of phase redistribution. Through the use of the weak formulation of the FEM, solution can be obtained for a heterogeneous medium with discontinuous or nonlinear properties. It also enables the handling of time dependent boundary conditions and hence problems involving wellbore storage with significant phase redistribution. In vertically heterogeneous reservoirs, inclusion of a separate model for the free fluid flow in the wellbore is essential to allow for hydraulic communication and mixing of the fluid issuing from different reservoir layers. A two dimensional model coupling Darcy flow in the reservoir with Navier-Stokes flow in the wellbore is developed and solved by the finite element technique. Contrary to conventional reservoir models, this new model is able to capture the wellbore storage effect directly and can handle wells with partial or complete perforations. In radially heterogeneous reservoirs, a special zonal discretization along with nonlinear regression is utilized to detect the interior boundary of heterogeneous zones. The results demonstrate that this numerical well-test procedure offers a new and completely general solution to capture the spatial variation of porosity and permeability in various boundary conditions.

کلمات کلیدی:

Finite Element Method, Weak Formulation, Phase Redistribution, multi-composite reservoirs, Coupling Wellbore-Reservoir, multilayer reservoirs

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