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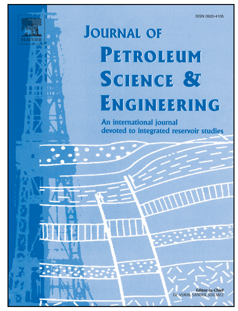

Time-dependent shape factors for fractured reservoir simulation: Effect of stress sensitivity in matrix system

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Time-Dependent Shape Factors for Fractured Reservoir Simulation: Effect of Stress Sensitivity in Matrix System

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Abstract: Matrix-fracture transfer functions are the backbone of any dual-porosity or dual-permeability formulation in the modeling of fluid flow in fractured porous media. The chief feature within them is the accurate definition of shape factors. To date, there is no commonly accepted formulation of a matrix-fracture transfer function and shape factor. Many unsteady transfer formulations of shape factors for incompressible reservoirs have been presented and used. However, the assumption of incompressible reservoirs for these formulations is not consistent with the in-situ reservoir conditions, and a few have been reported on the application of time-dependent shape factor on dual-porosity numerical reservoir simulation. The focus of this study is, therefore, to find the time-dependent shape factor for the single-phase flow of stress-sensitive reservoirs. In this paper, the stress sensitive curves and corresponding fitting equations of a fractured reservoir are obtained based on the laboratory physical simulation; and, a model for the determination of the time-dependent shape factors that considers the stress sensitivity is presented; then the solution of nonlinear pressure diffusivity equation is used to derive the shape factor; finally, the shape factor obtained in this paper is segmented by time and applied to the dual-porosity numerical reservoir simulation. The Boltzmann transform, the separation variable method and the method of power series are used to solve the nonlinear governing equation by considering the stress sensitivity in matrix system. The approximate analytical model for the shape factor presented in this paper is verified using fine-grid, finite element numerical simulation. The dependency of the shape factor on the matrix stress sensitivity is also investigated. The theoretical analysis presented improved our understanding of transfer flow in fractured porous media, and provides a new method for dual-porosity numerical reservoir simulation of fractured reservoirs.