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Mathematical Modeling Linked Volume Loss Data to LCM Selection to Cure Lost Circulation Wells in Naturally Fractured Formations

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Lost circulation is one of major drilling complications that cause low efficiency and high cost in drilling oil or gas wells in natural fractured formations. The current practice of mitigating lost circulation is still empirical due to the lack of understanding of near-wellbore conditions. This work presents three mathematical models to describe lost circulation through three mechanisms namely seepage/filtration in a fracture, pipe-flow in a fracture, and gravity displacement in a fracture. These types of loss mechanisms can be identified by the half-slope, 2/3-slope and unit-slope in the log-log plot of the loss volume data versus time. Fitting the loss volume data to the identified model allows toestimate fracture aperture/width for designing the particle size of lost circulation materials (LCM) to cure the well. The complex model for the gravity displacement was validated by an experimental data set. A field case study is presented in this paper to illustrate model applications and compare the result given by a sophisticated mathematical model. This work provides drilling engineers a practical method for identifying types of lost circulation and a means of estimating fracture aperture/width for selecting the particle size of LCM to cure their wells.

Biography:

Dr. Boyun Guo is the Director of the Center for Optimization of Petroleum Systems at the Energy Institute of Louisiana and Chevron-Endowed Professor at the University of Louisiana at Lafayette. His research interest is in the areas of oil and gas exploration and production engineering. He has published over 140 technical papers and authored 10 books in Petroleum engineering. Guo holds a B.S. degree from Daqing Petroleum Institute, an M.S. degree from Montana Tech, and a Ph.D. degree from New Mexico Tech, all in Petroleum Engineering.