

Numerical Analysis of Fluid Progression In Matrix Acid Stimulation

Jana Aljindan, Khalid Alrwaili, Mohamed Nouimehidi

Aramco

Abstract

Matrix Acidizing is an important operation in reservoir stimulation in carbonate formations. This operation requires careful design and operation in order to prevent any unwanted outcome. On the fundamental side, understanding how the fluids invade the porous medium is also important based on the nature of the acidic formulation and the injection type. The aim of this study is to understand the effect of reactivity of the acid and the rock in a porous medium using a Lattice Boltzmann approach. The acid-rock reactivity is simulated that how fast the fluid transfers between the pores in the same time, the porous space being increased due to the acidic reaction and the dissolving effect of the carbonate rock. The numerical results shows a lot details on the flow characteristics and the interactions between the acid and the rock. It was shown that the acid strength which was simulation by the reactivity resulted in different fluid invasion patterns, while in a weak formulation the fluid tends to spread radially, in a strong formulation the acid moves rather as a plug reacting with the whole rock matrix at once. The Lattice Boltzmann method is one of the best numerical approach and brings a new alternative to the conventional computational fluid dynamic (CFD). This works open the door to further analysis on the nature of the stimulation when different operation protocols are designed for any particular stimulation job.