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Characterization of Fracture Dynamic Parameters to Simulate Naturally Fractured Reservoirs

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Abstract

Fractures identification is essential during exploration, drilling and well completion of naturally fractured reservoirs since they have a significant impact on flow contribution. There are different methods to characterize these systems based on formation properties and fluid flow behaviour such as logging and testing.

Pressure-transient testing has long been recognized as a reservoir characterization tool. Although welltest analysis is a recommended technique for fracture evaluation, but its use is still not well understood. Analysis of pressure transient data provides dynamic reservoir properties such as average permeability, fracture storativity and fracture conductivity.

An infusion of geological knowledge helps reducing uncertainty associated with any well-test interpretation. The static properties of naturally fractured reservoirs such as fracture aperture, fracture spacing and fracture porosity can be obtained from processing of Image Log data.

Simulation of naturally fractured reservoirs needs defining fracture permeability, shape factor and fracture porosity in the fracture model. However, in most simulation studies, due to high uncertainties in estimating fracture permeability and shape factor values, these parameters are initially assumed in the model and they are usually tuned during history matching which can be time consuming and also affect other history match parameters. Reservoir simulation results and predictions might be inaccurate if the values of fracture properties in the model are not reliable.

This paper shows using image log data associated with welltest analysis in order to determine dynamic fracture parameters such as fracture permeability and shape factor for reservoir simulation. In this study, sensitivity analysis has also been performed on fracture permeability, fracture porosity and shape factor in a real simulation model to show importance of accurate determination of fracture parameters.

Introduction

Naturally fractured reservoirs differ from homogeneous reservoirs from many points of view: geological, petrophysical, production and economics. We may think of fractured reservoirs as initially homogeneous systems whose physical properties have been deformed or altered during their deposition. As a consequence, it is not always easy to match the behavior of these systems, specifically to forecast their production during simulation.

The major challenges in fractured reservoirs are: 1) They act as drains or barriers; 2) They significantly affect the