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Network Modeling and Two-Phase Flow in Tight Reservoirs

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Summary

This work summarizes a network modeling–based approach to understanding two-phase flow in tight (low permeability) porous media. This approach utilizes the concept of a porous medium as a set of connected pore bodies and throats of various configurations to understand relative permeability curves and capillary pressures in low permeability cores.

Introduction

Tight (low permeability) reservoirs are playing an increasingly important role in the global oil and gas industry due to a combination of new technology making production from them more economical and the exhaustion of conventional resources. However studying the flow of oil, water and gas through a tight porous media presents a new set of challenges due to phenomena such as permeability jail affecting two phase relative permeability.

Theory and/or Method

Martin Blunt at Imperial College London has developed a network model to simulate two phase flow through a porous media, but so far this program has been primarily used to generate relatively high permeability systems corresponding to conventional reservoir rock. This paper aims to investigate the usage and limits of Dr. Blunt's network modeling program to simulate two phase flow in tight rock conditions.

The methodology used was to gather porosity, permeability, and pore size data from a database on the Mesaverde tight sandstone formation from Kansas Geological Survey. Using this data as inputs a network model would then be generated through which two phase flow would then be simulated. The relative permeability curves and capillary pressure curves are then compared to experimental and curves calculated using Corey equations. The desired outcomes are to test the limits of the network model, to validate the model's results, and to determine how varying key parameters of the model affects its outputs.

Conclusions

The significance of this research is that network modeling and simulation is a quick and inexpensive way to understand reservoir behavior. If it can be shown the network modeling can be applied to tight rock reservoir conditions to generate accurate results, then significant economic benefits could be realized.

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