AAPG Search and Discovery Article #90007©2002 AAPG Annual Meeting, Houston, Texas, March 1-13, 2002

AAPG Annual Meeting
March 10-13, 2002
Houston, Texas

Zeno G. Philip[1], James W. Jennings[1], Jon E. Olson[1], Stephen E. Laubach[2] (1) The University of Texas at Austin, Austin, TX (2) University of Texas at Austin, Austin, TX

Modeling Coupled Fracture-Matrix Fluid Flow in Simulated Fracture Patterns

In conventional reservoir simulation, grid block permeabilities must frequently be assigned values systematically larger than justified by core measurements to obtain reasonable history matches. Even then, accuracy with regard to some aspects of reservoir performance such as water or gas cuts, breakthrough times, and sweep efficiencies may be inadequate. Often this discrepancy can be attributed to flow taking place through natural fractures not accounted for in the simulation. We present a numerical investigation into the effects of coupled fracture-matrix fluid flow on effective permeability.

A fracture mechanics based crack growth simulator was used to generate realistic fracture patterns based on reservoir properties such as the Young's modulus, sub-critical crack growth index, reservoir bed-height, and inferred rock strain. Coupled fracture-matrix fluid flow simulations of these fracture patterns were performed using both conventional finite difference and advanced boundary element simulators to obtain effective permeabilities that can be substituted as block permeabilities in a coarser scale flow simulation. Fractures were represented in finite difference simulators both explicitly as grid cells and implicitly using non-neighbor connections between grid cells. Comparisons were made between the results obtained with all three methods under different boundary conditions.

Preliminary results indicate that even though fracture permeability is highly sensitive to fracture aperture, the computed block effective permeabilities are more sensitive to fracture patterns and connectivity. The effects of diagenetic cements completely filling smaller aperture fractures and partially filling larger aperture fractures were also studied.