AAPG Annual Convention
Salt Lake City, Utah
May 11-14, 2003

Stephen G. Ahlgren and Paul Griffiths, Midland Valley Exploration Ltd, Glasgow, United Kingdom

Optimizing 3-D Fracture Networks Using Connectivity Analysis

Calibrated 3-D discrete fracture network (DFN) models can play a significant role in enhancing the understanding of fractured reservoirs. In many cases, however, DFNs are unrealistic in terms of their geological context or relation to available well data. To address these issues, we present a new method of tuning models using 3-D connectivity analysis. This approach provides an optimized DFN that better matches observed parameters within the framework of a realistic geological model, resulting in reduced risk in fracture modeling.

Synthetic DFNs are often generated to constrain or condition reservoir simulations, thus it is essential that they have similar statistical and topological characteristics as observed or interpreted fracture data. Analog fracture data from outcrops and wells can provide robust statistics on fracture orientations, clustering, and to a lesser degree, spacing. Fracture length, however, is poorly constrained, but may have a significant impact on the topology of the network. Thus it is important to be able to quickly construct and test multiple DFNs to establish the sensitivity of the model to the input parameters, including fracture length.

Our method generates multiple realizations of the DFN and tests them against fracture connectivity and well communication to assess the sensitivity of the network to the modeling parameters. A new optimization method refines these parameters by systematically generating DFNs, analyzing network connectivity, and comparing the results to known connectivity data interpreted from wells. The end result is a suite of modeling parameters providing a greater level of confidence by more closely matching observed data.