Uncertainty Analysis in Geomechanics Modeling for Fracture Prediction

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Abstract

Geomechanical modeling is a powerful tool in prediction of fracture distribution in fractured reservoirs. Better understanding of its uncertainty and limits would help us to improve our prediction and reduce inaccuracy of the result.

Several uncertainty sources in the modeling have been identified and discussed. These uncertainties include 1) seismic interpretation, 2) paleo stress orientation, 3) stress status, and 4) lack of hard data for validation. Since 2 and 3 are related to the knowledge of regional geology and tectonic history our focus in this paper is the impact of seismic interpretation on the results of geomechanical modeling.

We chose Jurassic section in west Kuwait where 3D seismic image is relatively blur and built fracture models based on two extreme interpretations, one addressing regional setup and one focusing local details. The major differences in these interpretations which are common in interpretations in other areas are 1) fault size in horizontal plane, 2) fault dimension in vertical direction, 3) fault location, and 4) fault geometry. They also show some similarities: 1) fault orientation, 2) fault density, and 3) cutting relationship.

Comparison and analysis of the results show that the uncertainty in fracture orientation is much higher than that in fracture density distribution. Finally, we quantitatively evaluate and list the uncertainty of predicted fracture versus interpretation differences.