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Determination of the optimum drilling direction of a horizontal wellbore in a naturally fracture reservoir using DEM

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A naturally fractured limestone reservoir around a 8 $^1/_2$¡ horizontal wellbore is modeled as a combination of intact rock blocks and permeable fractures utilizing the distinct element method (DEM). The present study utilized data from one of the fields in central Iran and the objective was to determine the optimum direction of drilling and safe mud weight window. By using analyzed image logs and core results, fractures orientation and density was obtained. It showed that most of the fractures are limited to the upper 70 meters of the reservoir. Based on estimated fracture density, two different model geometries were considered for two different depths. Using stress polygon, stress magnitude in a normal faulting regime was constrained for the reservoir. The analysis showed that the width of drilling mud window decreased as the fracture density increased which is due to faster and more drilling fluid loss. The main displacement around the wellbore was due to movement along fracture planes. The result also showed that the optimum direction of drilling was as the direction of minimum horizontal stress, i.e. N67W-S67E, for both geometries.