GMP02

Wellbore Stability Analysis Using Acoustic Radial Profiles and an Elastoplastic Model

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SUMMARY

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Abstract

Wellbore instability during drilling, completion, and production is an important and costly issue in many oil and gas fields. Because field observations show that stress-related wellbore instability problems are frequently encountered, the main objective of this study is to establish a workflow for wellbore stability modeling. The workflow was created using finite element wellbore modeling to predict induced stress concentrations and rock yield around the wellbore. Elastoplastic models were used in conjunction with the Mohr-Coulomb and other yield criteria. The second objective was to constrain these models using dipole radial profiles from an acoustic scanning platform.

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Wellbore instability during drilling, completion, and production is an important and costly issue in many oil and gas fields. Because field observations show that stress-related wellbore instability problems are frequently encountered, the main objective of this study is to establish a workflow for wellbore stability modeling. The workflow was created using finite element wellbore modeling to predict induced stress concentrations and rock yield around the wellbore. Elastoplastic models were used in conjunction with the Mohr-Coulomb and other yield criteria. The second objective was to constrain these models using dipole radial profiles from an acoustic scanning platform.

For this purpose we use advanced finite element methods. Using these techniques, unconfined compressive strength is calibrated by matching stress concentration around wellbore using dipole radial profiles from the Acoustic Scanning platform, and the damage or yielded zone was interpreted by means of volumetric strain analysis. This damage, or yielded zone, gives an indication of the potential breakout that might result during drilling, thus giving an indication of the risks to wellbore instability.

The workflow developed was applied to a several wellbore stability projects. Examples from Saudi Arabian gas reservoirs are provided. This methodology is flexible and transferable to other locations and reservoirs and this approach combines acoustic radial response and finite element modeling making it robust and realistic.