 ICCES, vol.16, no.3, pp.73-73

A Case Study of Mud-Weight Design with Finite Element Method for Subsalt Wells

X.P. Shen, A. Diaz , and T. Sheehy ,

Summary

This paper presents a case study for the design of a mud-weight window (MWW) with three-dimensional (3D) finite-element (FE) tools for subsalt wells. The trajectory of the target well penetrates a 20,000-ft thick salt body.

The numerical solution of the MWW for the target wellbore consists two parts: the shear failure gradient (SFG) and the fracture gradient (FG). Because the pore pressure and material distributions are nonuniform, the calculations of SFG and FG must be performed with submodeling techniques for a given depth point at a smaller local scale. A numerical scheme has been proposed for calculating the SFG and FG with 3D FE software. User subroutines have been developed to address nonuniform pore pressure distribution.

A series of FE calculations were performed to obtain the MWW of the target wellbore, which consists of the SFG and FG for the subsalt sections. Although no reverse faulting structure exists in the region at the salt base, the stress distribution at some region of the salt base has characteristics of a reverse fault. Additional analyses of the results show that this type of reverse-faulting stress pattern exists only in a small range of depth and width under the salt body. The stress pattern appears to be normal outside of that region. Consequently, a 3D solution of the MWW along the trajectory has abnormal values at a certain salt base section, which can be 10% greater than the value predicted by 2D software.

Keywords: Mud-weight window, subsalt wells, Finite Element Method, shear failure gradient, fracture gradient.