Title of the paper:

Well Bore Stability Using the Mogi-Coulomb Failure Criterion and Elasto-Plastic Constitutive Model.

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Abstract

Saving time and money are the results of the stable bore hole design. During drilling there are two main instability problems, namely, bore hole collapse and fracture. The consequences of these drilling problems are severe, even the most simple bore hole collapse or break down can lead to the loss of millions of dollars in equipment and valuable natural resources.

The main aspect of the well bore stability analysis is to mitigate these drilling problems. This is typically investigated by a constitutive model to estimate stress around the well bore, coupled with failure criterion.

The most common approach for stability analysis is a linear elastic and isotropic constitutive model in conjunction with linear failure criteria like Mohr-Coulomb. The Mohr-Coulomb failure criterion only involves the maximum and minimum principle stresses and therefore assumes that the intermediate principle stress has no influence on rock strength. In addition, it is believed that the fluid barrier, and a part of the bore hole wall, behave plastically which provides higher fracturing pressure than conventional elastic theory.

In this paper, a model for the mud weight window determination, using Mogi-Coulomb failure criterion and the elasto plastic model is developed. This is based on the hypothesis that, indeed elastic constitutive model does not fit with the reality of the well bore wall behavior and intermediate principle stress plays an important role on rock strength. This hypothesis is verified and is used in this paper for the South Pars gas field (phases 6, 7, and 8) in the Persian Gulf. This model leads to easily computed expression for the critical mud pressure required to maintain well bore stability.

Key words: Wellbore stability, Mud weight window, Mogi-Coulomb failure criteria, Elasto-Plastic theory.