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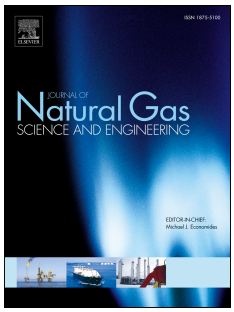


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# Evaluating Single-Parameter Parabolic Failure Criterion in Wellbore Stability Analysis

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## Abstract

Shear (breakout) and tensile (breakdown) rock failures are the most common wellbore instability challenges that may occur during drilling operations. In order to prevent these problems, stress concentration on borehole wall should be calculated using an accurate mechanical earth model (MEM). A comprehensive MEM should incorporate a failure criterion in order to predict the safe mud window. Thus far, several failure criteria have been utilized and discussed for the wellbore stability analysis in literature, but there is not any commonly accepted one in petroleum industry that generates the most reliable results.

In this study, first, Single-Parameter parabolic failure criterion was evaluated by reproducing unconfined compressive strength (UCS) from available triaxial tests. The results were then compared with measured uniaxial tests as well. It was found that Single-Parameter parabolic failure criterion is more accurate in reproducing UCS values than Mohr-Coulomb and Hoek-Brown. In the next step, Single-Parameter parabolic failure criterion was used in mechanical earth modeling of a real case study in Persian Gulf, Iran. Results indicated that Single-Parameter parabolic failure criterion overestimates the rock strength in a very low confining pressures, making it inapplicable for effective confining pressures of zero or very low. It also reflects higher breakout limits in very high UCS values which led to a misleading narrower safe mud weight window compared to other failure criteria.

Keywords: Single-Parameter parabolic Failure Criteria, Unconfined Compressive Strength, Breakout, Wellbore instability

## 1. Introduction

During the past decades, geomechanical studies have quickly extended from small-scale analysis of minerals to large-scale study of wellbore and reservoirs (Khatibi et al., 2017; Kong et al., 2017; Li et al., 2017; Convers-Gomez, 2017). While drilling, kick, borehole breakout, loss and