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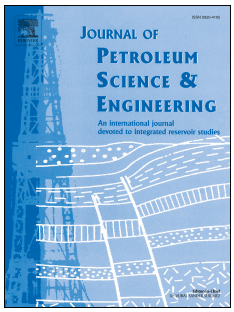

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PII: S0920-4105(18)30487-X

DOI: 10.1016/j.petrol.2018.06.003

Reference: PETROL 5010

To appear in: *Journal of Petroleum Science and Engineering*

Received Date: 12 January 2018

Revised Date: 23 May 2018

Accepted Date: 2 June 2018

Please cite this article as: Rostamsowlat, I., Akbari, B., Evans, B., Analysis of rock cutting process with a blunt PDC cutter under different wear flat inclination angles, *Journal of Petroleum Science and Engineering* (2018), doi: 10.1016/j.petrol.2018.06.003.

Analysis of rock cutting process with a blunt PDC cutter under different wear flat inclination angles

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Abstract

It is generally accepted that drilling with drag bits (Polycrystalline Diamond Compact bits) simultaneously consists of "pure cutting" and "frictional contact" processes. To date, the mechanics of rock cutting have been mostly based on the assumption that these two processes are fully independent as the influence of wear flat inclination angle (β) with respect to the cutter velocity vector ($\boldsymbol{v}$) on the frictional contact force is often not accounted for. The specific aim of this study is to determine the effect of wear flat inclination angle on the frictional force acting on the wear flat surface of a single blunt cutter over a wide range of depths of cut (d). For this purpose, an extensive and comprehensive set of cutting experiments was performed on two sedimentary rock samples (a limestone and a sandstone) using a state-of-the-art rock cutting equipment and a unique cutter holder. The results show that the normal contact stress (σ) at the wear flat-rock interface (and therefore the normal frictional force acting on the wear flat) is dependent on the depth of cut within the elastoplastic and particularly plastic regimes of frictional contact; however, the contact stress is invariant with depth of cut within the elastic regime. Further investigations indicate that the assumption that the force acting on the wear flat surface of

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