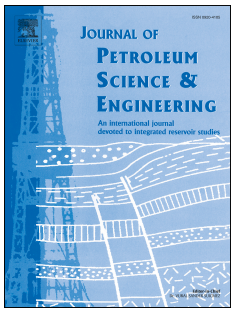
Accepted Manuscript



Modelling the load transfer and tool surface for friction reduction drilling by vibrating drill-string

Peng Wang, Hongjian Ni, Xueying Wang, Ruihe Wang

PII: S0920-4105(18)30090-1

DOI: 10.1016/j.petrol.2018.01.078

Reference: PETROL 4665

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

Received Date: 8 December 2017

Revised Date: 15 January 2018

Accepted Date: 30 January 2018

Please cite this article as: Wang, P., Ni, H., Wang, X., Wang, R., Modelling the load transfer and tool surface for friction reduction drilling by vibrating drill-string, *Journal of Petroleum Science and Engineering* (2018), doi: 10.1016/j.petrol.2018.01.078.

Modelling the load transfer and tool surface for friction reduction drilling by vibrating drill-string

Peng Wang[1], Hongjian Ni[1,*], Xueying Wang[2], Ruihe Wang[2]

(1. Research Institute of Unconventional Oil & Gas and Renewable Energy, China University of Petroleum, Qingdao 266580, China; 2. School of Petroleum Engineering, China University of Petroleum, Qingdao 266580, China)

Abstract: A unified mathematical model, considering the two mechanisms of static-dynamic friction conversion and friction decomposition, is developed to analysis the effect of different vibration manners and parameters on axial load transfer and tool face of positive displacement motor and evaluate the vibration level and dynamic security of the drill-string. A second-order finite difference method is used to solve this model. The change of weight on bit, rate of penetration and tool face of positive displacement motor under three different slide drilling manners are obtained. Simulation results show that the vibrations applied on drill-string mitigate the stick-slip and adhesion phenomenon and make the load transfer and movement of the drill-string smoother. The increment of weight on bit is the combined effect of the change of axial friction acting on drill-string and the exciting force. Among the three vibration manners, the axial vibration applied at bottom hole has the best friction reduction and tool face stabilization effects and the lowest vibration intensity. The torsional vibration applied at wellhead mainly affects the upper drill-string and has an optimal torsion angle subject to the torsional depth. The axial vibration applied at wellhead has a strong effect on the drill-string of vertical section. Results provide guidance and advice to the research and applications of friction reduction by vibrating drill-string.

Key words: Friction reduction; Vibration drilling; Load transfer; Tool face; Drill-string dynamic safety

1 Introduction

Drilling a complex structural well to exploit the unconventional oil and gas resources can ensure