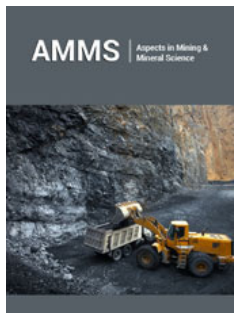


Research on Rotation Speed Equation of Drilling Bit Based on Intrusion Theory

Wenjie Li, Lisong Zhang*, Menggang Jiang, Shaoying Chen and Wei Wang

College of Pipeline and Civil Engineering, China University of Petroleum, China

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*Corresponding author: Lisong Zhang, College of Pipeline and Civil Engineering, China University of Petroleum, Qingdao 266580, China

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Abstract

To improve the accuracy of drilling bit speed equation, a standardized calculation equation for drilling bit rotation speed was established based on the Intrusion Theory. For practical application, the predicted results obtained by rotation speed equation are basically consistent with the actual drill bit rotation speed, which proves the accuracy of rotation speed prediction equation.

Keywords: Bit speed; Intrusion theory; Bit speed equation; Practical application

Introduction

Rotation speed of drill bit directly affects the progress of drilling and the evaluation of oil and gas reservoirs [1,2]. In view of this, a lot of research were carried out to establish a standardized calculation method for drill speed [3-5]. However, some shortcomings need to be noticed for these works, i.e., the neglected Intrusion Theory. Therefore, the rotation speed equation of drill bit would be established based on the Intrusion Theory.

Rotating Speed Equation based on Intrusion Theory

Based on the Intrusion Theory, the momentum theorem was applied to establish the rotation model of drill bit, seeing Eq.(1).

$$\frac{d}{dt} M_0 (mv) = M_0 (F) \quad (1)$$

$$M_0 (F) = \frac{T}{R} d_m = \frac{1}{2\pi R} \Delta P q \eta_m d_m \quad (2)$$

$$M_0 (mv) = \frac{1}{2} m R^2 \omega = \frac{1}{60} m R^2 \pi n \quad (3)$$

Eqs.(2) - (3) were substituted into Eq. (1), and then drill speed equation Eq.(4) was obtained:

$$n = \frac{30 q \eta_m}{\pi^2 R m} \Delta P \quad (4)$$

where F is horizontal force produced by screw drill torque, d_m is moment, m is the quality of drill bit, ΔP is pressure drop at inlet and outlet of screw motor, q is displacement per revolution of screw motor, η_m is mechanical efficiency.

Drilling Bit Speed Application

Figure 1 shows the predicted and actual rotational speed of drill bit in Wells I and II.

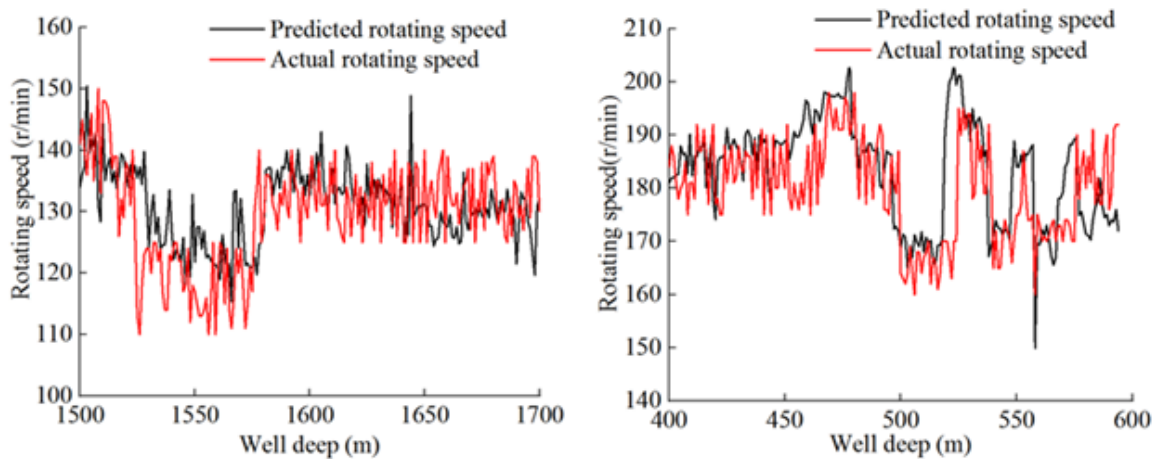


Figure 1: The comparison chart of predicted speed and actual speed of drill bit.

Conclusion

a. In this paper, the standardized calculation equation for predicting drill speed was established based on the Intrusion Theory.

The predicted speed obtained by bit speed equation is basically the same as the actual drilling bit speed, which proves the accuracy of rotation speed prediction equation.

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