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Measurement, Modelling and Prediction of Penetration Depth in Rotary Drilling of Rocks

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Abstract

Continuous process of deterioration (wear) of drill bit during rotary rock drilling leads to its blunting and losing of cutting capacity down to the point when it needs to be removed and replaced. Direct measurements of drill bit wear do not enable to assess the cutting capacity continuously during the running drilling process. Indirect method for wear assessment was developed based on relation between the wear and achievable penetration depth. Four theoretical mathematical equations were defined for characterization of theoretical behavior of penetration depth depending on applied thrust force. Experimental data were acquired in monitoring of core-drilling of Ruskov andesite using the experimental laboratory drilling rig with two surface-set diamond bits. Equation for calculation of efficient zone of drilling was derived, which enabled indirect assessment of drill bit wear grade during drilling process, which may lead to reduced energy consumption and lower costs for exchange of drill bits.

Keywords: core-drilling, andesite, surface-set diamond drill bits, penetration depth, mathematical modeling, efficient drilling.

1. Introduction

Cutting of rocks and mineral resources is one of the most demanding operations in both deep and surface mining and underground engineering.

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