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Simulation of Auto-drilling System of the Crust-1 Continental Scientific Drilling Rig

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In order to meet the requirement of the diamond drilling in the continental scientific drilling, the weight on bit should be controlled accurately. The auto-drilling system with constant drilling pressure, as the weight on bit control system of drilling, was mainly responsible for automatic drilling with constant drilling pressure when tripping or drilling, without the need for manual control. When drilling in homogeneous formations, automatic drilling system can guarantee the bit to get a smooth weight on bit, so that the bit jumping would be reduced in drilling process.

This paper was based on the continental scientific drilling equipment development project. According to the technical requirements of deep continental scientific drilling project, comprehensive analysis of the weight on bit, rotational speed and the pumping capacity was made for the technical requirements which was penetration rate, bit service life, footage per run, core recovery and borehole deviation. Through the formation conditions and drilling requirement, the optimal weight on bit was estimated.

The vertical stress of drill pipe system was analyzed in the paper based on the existing theory equation with constant drilling pressure [1][2]. The theory equation of constant weight on bit drilling system was deduced and the structure scheme was proposed. And then, the dynamic simulation of small motor auto-drilling system was made on AMESim, and results show that the luctuation range of the weight on bit can be up to ± 3kN.
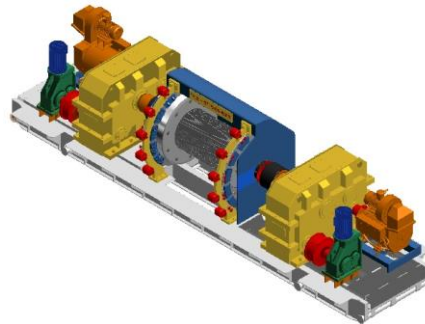

Figure 1: The Model of Auto-drilling System

References:

[1]Tejszersku D. Computer analysis of vibration of hoisting systerm. Computer Assited Mechanics and Engineering Sciences. 1997,4(2):179-188.

[2]Leonid Reznik,Omar Ghanayem,Anna Bourmistrov.PID plus fuzzy controller structures as a design base for industrial applications.Engineering Applications of Artificial Intelligence,2000(13):419-430.