The Turbine Parameter Study of Down-hole Turbine Generator of While Drilling for Exploring of China Sea

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ABSTRACT

The author discusses the development of the Turbine Parameter Study of Down-hole Turbine Generator of Logging While Drilling for Exploring of China Sea. He turbine generator is important to provide power to down LWD instruments. Put forward a kind of hydraulic turbine model of high performance and carry out the study of modeling. Perform the analysis the turbine blades model of different parameters in turbulent flow field and optimize the structure of the turbine by using fluent software. Analyze the conditions of the effect of the flow rate, rotational speed to the turbine flow field. Through ground experimental results verify the relationship of flow rate, rotational speed, and load and turbine generator output voltage. The established turbine model can meet the output power of improving turbine and ensure its working life. Adopt the field experimental the simulation of the accuracy of the results.

KEY WORDS: LWD, turbine generator, turbine, CFD, test

INTRODUCTION

Battery packs and turbine generators are the current primary means of down-hole power supply. However, as the constant flow of drilling fluid makes it possible for the turbine generator to work continuously in a long term task, and turbine generators are better able to handle the requirements of high-power down-hole instruments, they have the most promising future as down-hole power sources. In fact, turbine generators are already becoming the major power source for MWD/LWD systems, as they are able to continuously transfer the kinetic energy of mud into electric power.

Being the critical part in the energy conversion process, it is critical that the turbine is corrosion-resistant, hear-resistant, and small in size (Su and Dou, 2005; Liu, Pang and Jin, 2008). In recent years extensive research has been done to make the turbine generators more durable and simple in structure, as these aspects are also critical for their optimization. From modeling to manufacturing, a lot of work has been done to this points specifically with turbine blades (Zhang, Chou and Han, 2009; Han and Zhang, 2010; Feng, Zhang and Zhang, 2009; Jian, Wang and He, 2008). However, due to various electrical parameters of down-hole instruments and the fact that flow channels are determined by the structure of specific drilling equipment, the power and control modes of turbine generators differ from one to the next. Therefore, all turbine generators still need to be customized for particular equipment and are not yet optimized.

By studying the flow field using Fluent software, this paper determines an optimized form of the turbine model with a high energy transformation rate, low blade stress, and better flow field, and establishes a multi blade turbine model with variable wall thickness. Additionally, hydraulic experiments have been carried out to verify the relationship between the output performance of the turbine generator and various working parameters such as flux, rotating speed, and workload.

TURBINE BACKGROUND

While drilling forward, the high-speed mud flow brought by the drilling string is redirected by the flow guider, and then impacts against the turbine blades. The kinetic energy absorbed by the turbine blades is converted into mechanical energy that drives the turbine axis to rotate. The accelerated turbine axis drives the generator rotor to rotate in the magnetic field. The armature coil mounted externally on the rotor cuts the magnetic-curves and produces current.

Once a permanent magnet is magnetized, its magnetic characteristics cannot be easily adjusted, which leads to difficulties in voltage regulation of permanent magnet generators. Although permanent magnet generators offer a lower change rate in voltage compared to excited generators, voltage stabilization will still be necessary on occasions when high stability of the voltage is required. Hybrid excitation has proven itself a good choice so far. In a hybrid excitation generator, the major part of the air gap field is generated by a permanent magnet and a changeable part required for voltage adjustment is generated by a supplementary magnet winding. In this paper, voltage regulation is achieved in the form of induction generators. A control coil is used to maintain the voltage stability of the generator.