TU Clausthal

DSC
Drilling Simulator Celle

Master Thesis

Simulation of Bit Walk

Reduction of drilling costs in the oil and gas and geothermal industries is one of the main reasons for high investments in research and development. One important subject is reducing the Non-Productive Time (NPT) in drilling operations by optimizing the drilling process through realistic hardware- and software simulators. Software simulators are used to model different aspects of the drilling process, among others drilling performance, fluid dynamics and particle transport. Hardware Simulators verify these models under realistic boundary and initial conditions.

At Drilling Simulator Celle (DSC), both hardware and software simulators are available to conduct the research and the experiments required to optimize the drilling process and model downhole phenomena. Previous work already studied rate of penetration (ROP) extensively using empirical models and methods from machine learning for modelling the drilling process. All of these models were integrated in a unified python framework that is interacting with the software simulator of the DSC. The next drilling phenomenon to be modelled is Bit Walk. The purpose of this work is to understand and simulate the movement of the bit including its impact on ROP and the drilling trajectory.

In this work, a review of the existing models for Bit Walk should be done to understand the tendency of where the bit is moving. Later, the models have to be evaluated for the application in the use cases of the DSC. The use of methods of machine learning depends on candidate´s interests. The aims of this thesis are the evaluation of the Bit Walk models using real measurement data and their integration in the existing python framework. General knowledge of drilling technology is required. Knowledge in Python programming and machine learning is beneficial but not mandatory.

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