Drilling Speed Optimization and Vibration Mitigation for Directional Drilling using Bayesian Optimization

**TECHNISCHE UNIVERSITÄT DARMSTADT**

Baker Hughes

Proposal for a Master's Thesis Topic

Directional drilling involves steering a downhole assembly along a predefined three-dimensional path, typically to reach underground reservoirs. Optimizing the drilling speed is vital to reduce the operational costs and is achieved by adjusting surface drilling inputs like *weight on bit* or *drill string rotation speed*. However, these adjustments must be carefully managed to prevent harmful vibrations in the drill string, ensuring the safety of the drilling process.

Within the scope of this thesis, you will explore the application of Bayesian optimization to improve the drilling speed while minimizing the risk of unwanted drill string vibrations. This entails a literature review on directional drilling and relevant machine learning techniques, focusing on (multi-fidelity) Bayesian optimization. Subsequently, these techniques will be tested using a virtual test environment. Additionally, you will explore the idea to leverage the available data from nearby well bores to enhance the prediction and optimization capabilities of the Bayesian optimization process.

The thesis can be done in English or German, but proficient English skills are required. A strong background in control engineering and machine learning is mandatory alongside experience in MATLAB/Simulink and/or Python for algorithmic implementation. Prior knowledge in Bayesian optimization is helpful but not strictly required. If you have any questions, feel free to contact us.

The thesis is offered in cooperation with the Baker Hughes Company.
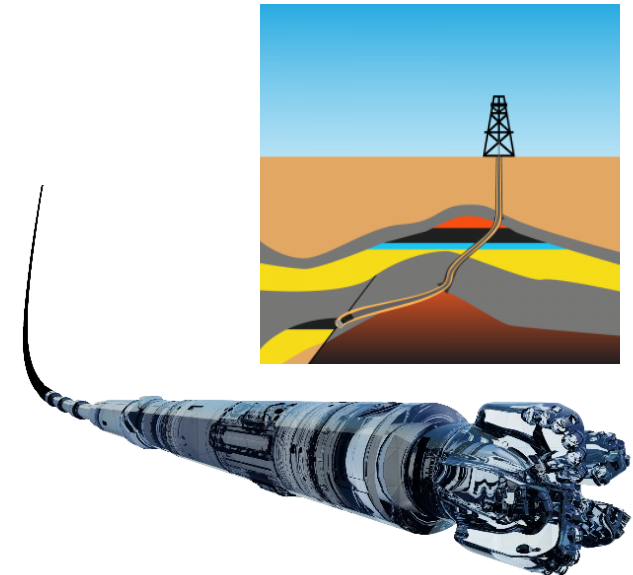
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CCPS Control and Cyber-Physical Systems