

Online Process Monitoring to Enable Adaptive Drilling Processes

Background

During vibration-assisted drilling (VAD), multi-layer material stacks are machined, and their properties change during the drilling process. Forces, spindle currents, and machine-internal signals can provide indications of parameter changes, material-layer changes, tool wear, and process quality.

Goal

The goal is to investigate how reliable live monitoring can be implemented and what proportion of the signals from the entire drilling process is required. Ideally, this should allow hole quality or tool wear to be estimated quickly enough to enable process adaptation during drilling.

Task

The work includes:

- Evaluation of available sensor signals for online monitoring
- Determination of the smallest usable data window within a drilling process
- Change-point detection for parameter and material changes
- Comparison of suitable methods for live signals
- Evaluation of latency, computational effort, and possible triggers for adaptive parameter adjustment

Requirements

- Programming skills, ideally in Python and PyTorch
- Interest in machine learning and process monitoring
- Experience with time-series data is advantageous, but not required
- Initiative, a structured approach to work, reliability, and commitment

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