

MSc-topic proposal, spring 2014:

Automated Evaluation and Control of Drilling Fluid Hydraulics during Conventional Drilling Operations

Cybernetic Drilling Technologies (www.cdt.no) is a Norwegian technology company that delivers various automated drilling rig systems and components to the drilling industry, both for petroleum and geothermal applications. Main focus is to ensure a safe and efficient well construction process. In the recent years, the wells to be constructed are becoming more complex and this requires new types of drilling procedures and various specialized tools and equipment.

CDT is currently developing a system for conditioning the drilling fluid automatically during drilling operations. Focus is to evaluate and adjust the density and rheology properties of the drilling fluid based on measuring the drilling fluid flow using differential pressure transducers. The drilling fluid composition is then adjusted by adding either densifying liquid, viscosifying liquid and/or diluting liquid into the drilling tank.

Scope of work:

- 1) Literature survey within drilling fluids.
- 2) Extend the Kaasa wellbore model to include «wellbore time delay», non-Newtonian drilling fluids, and gelling. If possible, also include salt (NaCl) effects.
- 3) Add wellbore disturbance effects, (drilling fluid density dilution, NaCl contamination -> causing rheology changes)
- 4) Add surface drilling fluid treatment plant model (density change and rheology change).
- 5) Define control structure for the drilling hydraulics, both surface and downhole, preferably cascade.
- 6) Define operational sequence used for evaluating the control structure.
- 7) Evaluate the control structure using the implemented extended Kaasa model.

The modeling work, simulations and control algorithms will be implemented using MATLAB. The work may be conducted at NTNU in Trondheim or at the CDT offices in Bergen. Supervision will be given both at CDT and at NTNU. Travel expenses between Bergen and Trondheim will be paid.

Bergen,
October 8th, 2013