Advanced Model for Drilling and Well Operations

A general dynamic model for single and multi-phase flow operations during drilling, completion, well control and intervention

Advanced hydraulics modeling
The SINTEF model is an advanced, transient, integrated hydraulics and thermal wellbore model, based on many years of development and use in offshore drilling operations. The main features are:

- Two-dimensional dynamic temperature model
- Two-phase flow
- Compositional PVT
- Pressure and temperature dependent density and rheology
- Transient drilling operations
- Multiple well control methods
- Pressure/ECD, temperature, and pit volume vs. time while drilling, circulating and displacement, including flow of cuttings.
- Transient well pressure and flow vs. time
- Surge and swab effects
- ESD and temperature vs. time during static periods, e.g. flow tests.
- Transient pressure and flow vs. time while resuming circulation after static periods.
- Real-time enabled

Projects and Commercial Products
The model is an essential part of many products and solutions for both automatic control and monitoring and advisory systems, including:

- eDrilling
- eControl
- Gullfaks C MPD project
- Kvitebjørn MPD project
- Drilling Training simulator
- Controlled mud pressure technology
- Well control studies
- Validation of new drilling concepts

The physics of a well and flow model

Photo: Statoil
Offshore operations
The model has been used successfully in 7 managed pressure drilling operations with automatic pressure control in the North Sea. The model is an essential part of the control loop, by calculating the necessary surface pressure to keep a constant bottomhole pressure. In addition to use for planning upcoming operations, the following operations have been performed with automatic control based on the SINTEF model:

- Drilling and tripping
- Running of 7” liner
- Cementing a 7” liner
- Displacement operations
- Placement and displacement of “balanced mud pill”

Publications
- SPE/IADC 130311, 2010. Successful use of real time dynamic flow modeling to control a very challenging managed pressure drilling operation in the North Sea.