

Improving borehole instruments

Devico specializes in the development and manufacturing of directional drills and borehole survey instruments for mining, geotechnical and civil construction purposes. Devico has some of the world-leading products for these applications and is based in Trondheim.

During drilling, the boreholes will almost invariably start to deviate from the plan. For this reason, the measurement of boreholes and estimation of their trajectory is increasingly becoming a standard and a requirement. Borehole surveying creates large amounts of data that must be handled efficiently. To this end, Devico has a cloud-based data management system for borehole data – DeviCloud. It allows the field operator to upload the survey data, and the Geologist can inspect the results immediately. DeviCloud contains thousands of surveys and the database increases by hundreds of surveys every day from around the globe.

With such a large collection of data sets available, it is not unnatural to consider that it can be exploited in various ways, possibly beyond that of extraction of statistical quantities.

Borehole surveying is conducted using inertial navigation instruments. The primary sensors are accelerometers and gyroscopes. Borehole surveying has some characteristic properties, that can be exploited:

- Surveying is typically performed with a well centralized instrument, and surveying is most often done both in and out. The instrument starts and returns to the same location and travels the same trajectory up and down. This means that frequently one has two or more independent data sets for the same hole.
- The quality of surveying results is typically measured via standard deviation: If multiple surveys in the same hole show highly repeatable results (low STD) the quality is deemed good. As these are indeed independent data sets, highly concentrated results tell the same story and are therefore trustworthy.

With this background, Devico invites students to explore possibilities such as:

- Extraction of statistics.
- Early warnings on instruments that perform worse than can be expected.
- Study large data sets and see if the performance of an instrument can be improved. Can improved calibration constants be derived from field data?
- Aging trends. How is the instrument performance as a function of time?
- ...

Finally, in addition to the unsupervised data sets in DeviCloud, we have large amounts of data collected during controlled calibration sequences in our lab. For the interested student, there are some opportunities here as well.

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