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Early Identification of Drilling Collision Risk Using MWD Survey Quality Data

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Abstract

By identifying changes in the error characteristics of magnetic surveys while drilling, crews can be alerted early on to a potential close approach with an offset well. This alert does not require expert analysis prior to trigger, enabling safer deployment of remote monitoring and drilling automation systems.

That magnetic interference can be used to identify offset wells has been long known, however identification of the interference pattern is not always straightforward. Safe operation in close-approach situations currently requires proactive monitoring by an expert. This new method uses a conditional expectation of survey quality parameters ("marginal sigma") trained on previously accepted surveys to identify new errors. Quality control data from several wells with known close approaches are analyzed with this technique alongside traditional survey quality assessments. Automatic flagging of high-risk surveys for review would enable proactive monitoring workflows to be replaced with "management by exception" workflows making more efficient use of expertise.

Survey quality data from several close approach scenarios were analyzed using traditional QC methods along with the marginal sigma method. Traditional QC measures are not readily adapted to automated identification of offset wells. Problematic situations include cases where:

1. Surveys are already failing QC for a known reason,
2. External interference temporarily improving QC data masks the problem,
3. The onset of interference is too small to cause an immediate QC failure.

In light of this, traditional QC parameters still require proactive monitoring by an expert individual. Using the marginal sigma estimation, even small changes in magnetic measurement patterns are identified and escalated for review. These changes are often detected with even a single outlier survey, implying that escalation would occur as quickly as with the most vigilant observer. This system would be of particular value in situations where a limited number of experts are used to oversee a high volume of work, such as remote monitoring in North America Land, or in the future, supervising autonomous drilling systems.

The proposed system changes the drilling supervision requirements for what has previously been a high-risk scenario (collision avoidance drilling). Proactive monitoring by an expert can be safely transitioned to a "management by exception" system enabling better utilization of resources.