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High Sensitivity Gravity Measurements in the Adverse Environment of Oil Wells

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Bulk density is a primary measurement within oil and gas reservoirs and is the basis of most reserves calculations by oil companies. The measurement is performed with a gamma-ray source and two scintillation gamma-ray detectors from within newly drilled exploration and production wells. This nuclear density measurement, while very precise is also very shallow and is therefore susceptible to errors due to any alteration of the formation and fluids in the vicinity of the borehole caused by the drilling process. Measuring acceleration due to gravity along a well provides a direct measure of bulk density with a very large depth of investigation that makes it practically immune to errors from near-borehole effects. Advances in gravity sensors and associated mechanics and electronics provide an opportunity for routine borehole gravity measurements with comparable density precision to the nuclear density measurement and with sufficient ruggedness to survive the rough handling and high temperatures experienced in oil well logging. We will describe a borehole gravity meter and its use under very realistic conditions in an oil well in Saudi Arabia. The density measurements will be presented.

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