

The Paradox of Anisotropy Generalized to Deviated Wells in Orthotropic Media

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Abstract

The paradox of anisotropy states that “*any electric survey in a vertical well through a horizontally laminated formation with negligibly small borehole is blind to the vertical component of the resistivity tensor and will only measure the horizontal resistivity component parallel to the laminae*”. This theorem generalizes to orthotropic (triaxially anisotropic) media with arbitrary orientation and electric surveys at any direction.

The generalized paradox of anisotropy states “*Any axisymmetric electrode measurement in an orthotropic medium is blind to the resistivity-tensor component aligned with the tool axis and only measures an apparent resistivity, which is the square root of the determinant of the reduced tensor in the plane perpendicular to the tool axis.*” The presentation will derive and prove this statement as theorem in full mathematical rigor.

Short Biography

Martin G. Lüling holds a Doctorate from Princeton University with a thesis in theoretical particle physics. He worked for Schlumberger Oilfield Services for 35 years as a theoretical physicist on the development of measuring instruments and methods, as well as the processing and interpretation of the measurement data for oil and gas exploration. He contributed significantly to the development of electromagnetic measuring instruments while drilling and their application as steering control for directional drilling. He developed inversion methods for tomographic measurements and associated instruments. Today Martin works as a physicist and inventor through his company Luling Tech SAS and as a permanent guest at the Physics Department of Ecole Normale Supérieure in Paris. He lives in Paris, enjoys French cuisine and wines, plays cello, double bass and blues guitar.

