KMS Technologies

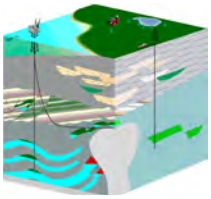
Innovating Solutions

3D modeling software MAXANIS

Product Description

KMS Technologies provides a variety of electromagnetics modeling software including applications for CSEM (land and marine), surface, surface-to-borehole, and borehole environments. All codes were developed in-house by 3DEM Holding LLC and were merged with KMS Technologies.

The 3D modeling software MAXANIS™ has been used by several industrial users including BHI, Shell, Weatherford, EMGS & Schlumberger, where it is an integral part of their workflow and decision process.



For certain application the software is available to run on KMS' cluster, for other we license copies.

Fast and reliable, MAXANIS™ handles hydrocarbon reservoirs with arbitrary anisotropic resistive media and complex structural interfaces. This provides a crucial contribution to the success of EM technologies in addressing the needs of the exploration & production industry.

3DEM's core technology is based on proprietary 3D EM finite-difference (FD) modeling software that has been rigorously tested, validated and benchmark tested. The software can be applied for most 3D electromagnetic problems whether located in borehole, land, or marine environments. It incorporates complex terrains, seafloor bathymetry, subsurface geology, arbitrary 3D anisotropic resistive media and much more. This best-in-class software is proven to be more robust at much faster execution times than comparable products.

All 3DEM modeling software modules and applications are available for licensing (unless marked), including technical support & training:

MARINE & LAND 3DEM SOFTWARE

MAXANIS™– General 3D FD EM modeling software, arbitrary 3D anisotropy.

Applications: CSEM in frequency- and time-domain.
FSEM (Focused-Source EM) in frequency- and time-domain.
Magnetotellurics (MT).
Ground-Penetrating Radar (GPR) in frequency-domain.

BOREHOLE 3DEM SOFTWARE

MAXANIS™– General 3D FD modeling software, arbitrary 3D anisotropy.

Applications: Propagation resistivity for LWD and induction measurements as developed by major service companies
General time-domain measurements
Galvanic (DC) land & marine or cross-well measurements
Surface-to-borehole measurements (restricted)

3DEMcyl General 3D FD modeling software in cylindrical coordinates.
General resistivity LWD and induction measurements.
General time-domain measurements.
EM modeling in cylindrical coordinates.

MAXAN1D Fast 1D modeling of propagation resistivity and induction-type instruments.
Arbitrary, biaxial anisotropy.

Additional 3D products:

3D interpretation services
Land EM survey feasibility

KMS Technologies

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Product specification & applications

Data input:

- Will be adapted to customer requirements
- Efficient treatment of air-Earth or air-water interface: topography or bathymetry available

Standard outputs:

- 3D model with visualizer
- Models & curves as per customer requirements

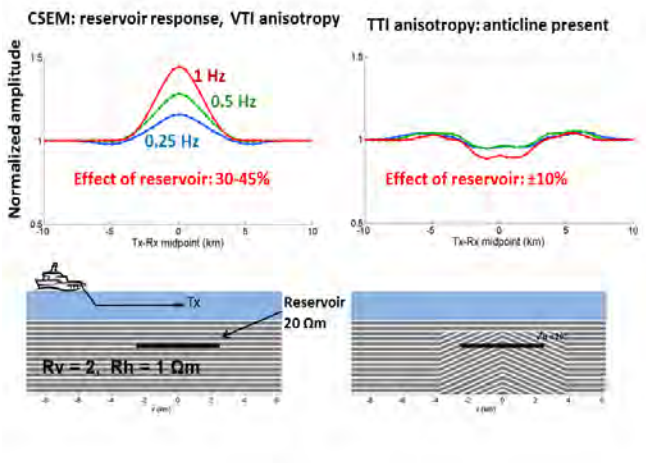

Figure 1: Frequency-domain CSEM application with synthetic 3D reservoir and arbitrary TTI (tilted transversely isotropic) versus VTI (vertical TI) anisotropy. The reservoir anomaly is significantly affected by the anticline.

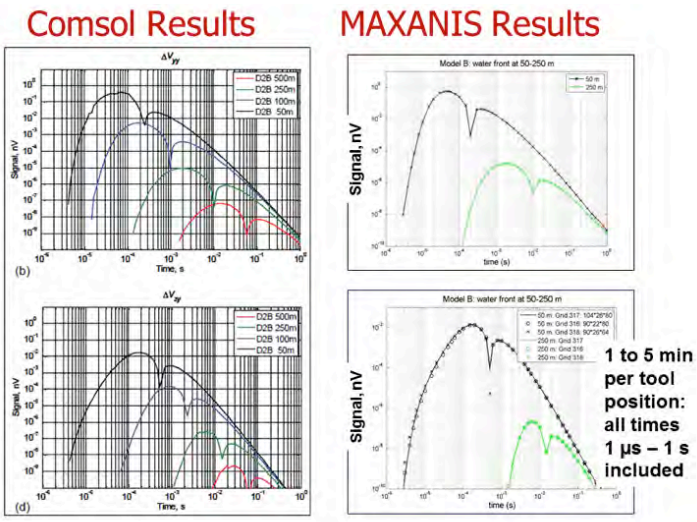

Figure 2: Reservoir monitoring in time domain: modeling comparison versus Comsol results, on the left, published by Dutta et al. (2012); MAXANIS™ results: on the right.

Benchmarks

1. **Time-domain land/marine EM survey**: see Davydycheva et al. (2006), Davydycheva and Rykhlinski (2009; 2011), Davydycheva et al. (2015).
2. **Frequency domain Controlled-Source EM and magnetotelluric surveys**: see Davydycheva and Rykhlinski (2009; 2011), Frenkel and Davydycheva (2009), Zaslavsky et al. (2011), Frenkel and Davydycheva (2012), Davydycheva and Frenkel (2013).
3. **Ground-penetrating radars and near-surface EM application for detection of clandestine tunnels**: see Frenkel and Davydycheva (2010).
4. **Conventional induction well-logging**: see Anderson et al. (1999).
5. **Triaxial induction logging**: see Davydycheva et al. (2003), Rosthal et al. (2003); Barber et al. (2004); Abubakar et al. (2006), Wang et al. (2006), Wang et al. (2008), Davydycheva et al. (2009), Davydycheva (2010a; 2010b), Davydycheva (2011a; 2011b), Davydycheva et al. (2014).
6. **Full 3D inversion of triaxial induction logging data**: see Abubakar et al. (2006), Wang et al. (2008), Davydycheva and Kaminsky (2016).
7. **Resistivity logging-while-drilling**: see Anderson et al. (1997), Davydycheva (2010a; 2010b), Davydycheva (2011a; 2011b), Pour et al (2011).
8. **Cross-well and borehole-to-surface EM**: see Zaslavsky et al. (2011), Strack et al. (2016).
9. MAXANIS and 3DEMcyl have been used by Baker Hughes, Schlumberger and Weatherford for logging tool design.