



A Comprehensive Solution for Geologists and Reservoir Engineers

In order to present informed reserve estimates, one needs reliable production forecasts, which can only be achieved if they are based on an accurate description of the reservoir. This in turn is dependent on the joint efforts and knowledge of reservoir geologists who construct the geological model, and reservoir engineers who perform a flow simulation of that model.

Until now, these two processes have been completely separate – once the geological model leaves its environment for the engineer’s desktop, it never returns. The Paradigm™ Reservoir Engineering product suite, powered by SKUA® and the patented UVT Transform® technology, bridges that gap by providing a collaborative modeling environment which enables geologists and reservoir engineers to understand, quantify, and document the impact of reservoir geology on production forecasts. It allows geoscientists and reservoir engineers to

efficiently forecast production, assess reserves and optimize field development, while yielding geologically sound production forecasts and production-coherent geological models. Eliminating the need to transfer data from application to application saves project turnaround time, while preserving data integrity.

For reservoir engineers, it also provides a collaborative reservoir flow simulation workflow that enables the production of geologically consistent production forecasts, as well as engineering validation of the reservoir models.

Unlike competitive offerings that can only construct pillar grids which may not accurately reflect the reservoir geometry and may lead to numerical errors in flow simulation, Paradigm Reservoir Engineering offers an efficient and systematic integrated approach to coherent reservoir forecasting. Reservoir grids created using the Paradigm application maintain the integrity of the geology, limit numerical errors in flow simulators, and deliver simulation-ready reservoir models.

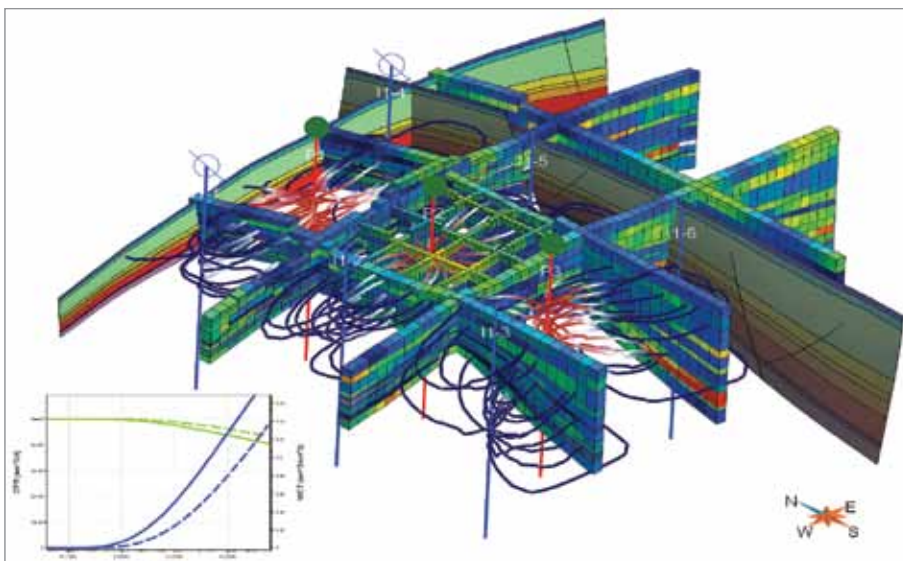
UVT Transform: A New Understanding

The UVT Transform technology was developed on the premise that 2.5D pillar gridding is insufficient to describe 3D reservoir models.

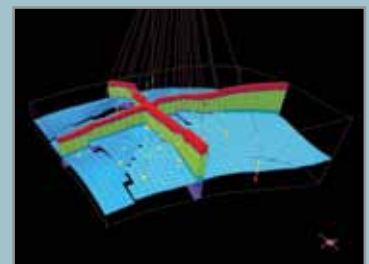
The UVT Transform is based on true 3D technology, which enables the modeling of reservoir properties and other attributes in their true depositional state, resulting in accurate reservoir models. This technology also allows the construction of optimal flow simulation grids which best respect cell orthogonality requirements, while handling any faulting.

The true 3D approach of the UVT Transform also guarantees a geologically coherent upscaling between the fine-scale geologic grid and the upscale flow simulation grid, as both are issued from the same UVT model.

Finally, the UVT Transform enables the creation of flow simulation grids with curvilinear pillars potentially aligned in 3D on the main faults, and/or stair-steps along antithetic faults.



SKUA reservoir engineering streamlines LGR, production curves, and grids



Flow simulation grid inside a Y fault zone showing the required stair-step gridding

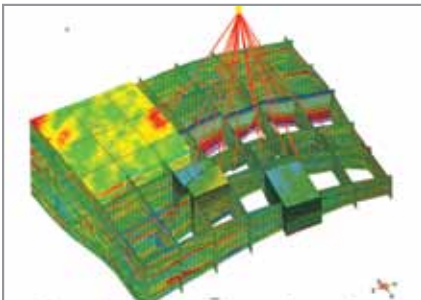
Data Sharing Delivers Fast Results

Paradigm Reservoir Engineering uses the patented UVT Transform technology to construct reservoir grids that are optimal for numerical flow simulation. Users can compare the dynamic behavior of fine geological models and coarse flow simulation models, set up and launch multiple flow simulation scenarios, and analyze and manipulate flow simulation results. Reservoir models may be screened by rejecting those whose dynamic behavior is inconsistent with field observations.

All modules are workflow driven to enable rapid iterations for production uncertainty analysis and history matching, while preserving the integrity of the geological model. The workflow approach is unique: It facilitates use of the software by non-expert users, and generates a rigorous audit trail by preserving all information related to the models.

Flow Simulation Grids

The Flow Simulation Grid module enables the construction of reservoir grids optimized



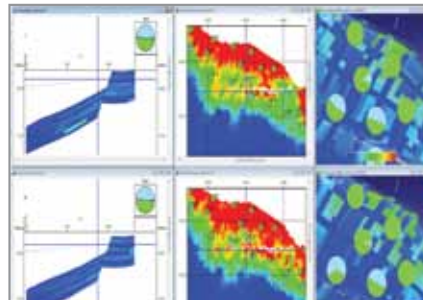
Flow simulation grid with LGR

for flow simulator requirements. The grids can be constructed, regardless of the structural and stratigraphic complexity of the subsurface, by creating stair-step faults. They can then be exported to all commercial flow simulators.

Production Data Analysis/ Reservoir Simulation Pre-processor

These modules provide a collaborative environment for geoscientists and reservoir engineers. They enable the creation of input parameter files for commercially available reservoir flow simulators, the launch of simulation runs, and the loading, visualization, analysis and manipulation of historical production data and flow simulation results.

These applications are aimed at facilitating the comparison of alternative flow simulation scenarios. They also allow the investigation of uncertainty in both geological and flow simulation models, providing an understanding of the most important parameters and highlighting those models which are closest to



Multi-scenario reservoir simulation analysis

observed historical production data scenarios and stochastic simulation.

LGR and Upscaler

The LGR and Upscaler module provides a systematic yet flexible approach to grid coarsening (upgridding) and property upscaling; grid refining (downgridding) and property downscaling; and local grid refinement (LGR) construction, visualization and export to commercial flow simulators.

Fracture Modeling (FracMV™)

FracMV (developed by structural geology experts Midland Valley) uses fracture density and orientation information to generate geologically constrained discrete fracture networks (DFN). It provides a method to generate fracture-related flow properties directly from the fracture network, which can then be exported to a reservoir flow simulator.

Interoperability

- Epos 4.1
- OpenWorks® 2003.12, R5000
- GeoFrame® 4.5
- Rescue/RESQML™/WITSML
- ECLIPSE/CMG/MIP

System specifications

- Microsoft Windows 7, Vista, XP Professional (32 & 64-bit)
- Red Hat® Enterprise Linux® 5.3 and above, 6.0 and above (64-bit)

The Paradigm Advantage

- + Improves project turnaround time while yielding geologically sound production forecasts and coherent geological models.
- + Seamless integration of reservoir modeling and flow simulation eases collaboration between geoscientists and reservoir engineers.
- + Early understanding of the dynamic behavior of reservoir models enables focus on geological features that impact production.
- + Production uncertainty assessments based on multiple geological scenarios facilitate efficient investigation of development risks.