TECHNICAL SPECIFICATIONS

KronosFlow™
2D Kinematic Restoration

Software Presentation

KronosFlow is a unique software solution to produce 2D kinematic scenarios for basin and petroleum system modeling purposes. Starting from cross section present day drawing, KronosFlow features all required functionalities to restore its structural evolution through geological times while meeting basin modeling constraints. KronosFlow output is a series of paleo-sections sharing a single mesh continuously deformed, adapted to sedimentation, erosion, and basin shortening and/or extension.

Taking advantage of an intuitive and workflow-oriented interface, KronosFlow offers the following key steps:

- Present day section building and balancing
- Kinematic restoration
- Sublayering
- Meshing

Combined with TemisFlow™ 2D Complex Tectonics and its new generation simulator able to handle this unique mesh, this technology not only allows accounting properly for structures geometries at present day and through time but also simulating faults impact on water and hydrocarbon flows with a rigorous approach. It is the mandatory tool for the exploration of complex regions where classic basin modeling solutions do not accurately manage the combination of lateral and vertical tectonic displacements.

Functionalities & Algorithms

DIGITIZATION

- Creation and digitization of geological features (horizons, faults, erosion surfaces, borders)
- Possibility to use a background image
- Lines editing tools (edit, cut, merge, translate, erase)
- Automated lines QC and cleaning for 2D model creation
- Stratigraphic scale management
- User-friendly workspace (mouse-driven zoom and navigation)

BALANCING

- Automatic flattening of fault blocks on a given horizon
- Horizon modification in flattened mode and impact on present-day geometry

SECTION PROPERTIES ASSIGNATION

- Automated stratigraphy assignation
- Lithology assignation with possible lateral variations

LITHOLOGY MANAGEMENT

- IFPen databank with reference lithologies
- Creation of user-defined or mixed lithologies

- Possibility to tune and define:
    - Depth-compaction curves
    - Mechanical parameters (Young's modulus and Poisson's ratio)
- Full compatibility with TemisFlow™ lithology library

STRUCTURAL RESTORATION

- Several deformation methods available
- Intuitive constraints definition
- Backward, forward, redrawing if necessary
- Erosion
- Moderate ductile deformation
- Decompaction
- QC Tools
- Undo/Redo available

DEFORMATION METHODS

- Geometry driven methods
    - Oriented shear
    - Flexural slip
    - Moving least square
    - Line length unfolding
- Mechanic driven method (finite elements)
- Manual edition of geometries:
    - Point by point
    - Within a radius of influence
    - Line redrawing (with automatic point projection)

ADVANCED CONSTRAINTS DEFINITION

- Several constraints application modes:
    - Bi-constraints (on fault and horizon)
    - Sliding (on faults and/or sliding horizons)
    - Multiple constraints (on points and/or lines)
    - Deformation-guiding point (anchor)
    - Internal line selection
- Target line definition (pin line, paleobathymetry, or other)
- Lines grouping
- Automated selection and detection of sources and targets
- All mouse-driven

EROSION RESTORATION

- Manual or automatic drawing of eroded material
- Multiple layers management
- Automated detection of stratigraphy and lithology

SEDIMENT DECOMPACTION

- On demand or at key stage creation
- Based on porosity-depth curves

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GRAPHICAL AND QC TOOLS

- Viewing mode by Age, Facies or Fault Block
- Background grid pattern
- Background image
- Thumbnail visualization of key steps
- Distance and angle measuring tools
- Automated area variation QC along the restoration
- Key steps comparison
- Quality control on section geometry, contacts, and geological features consistency

KINEMATIC SCENARIO TREE

- Implicit tracking of all operations with a clear identification of key steps
- Easy testing of hypothesis and alternative scenarios
- Comparison of deformation methods and kinematic scenarios
- Easy go back and forth
- Restoration path duplication: possibility to add already restored steps to a newly created step by copy/pasting a branch of the tree

RESTORED SECTION AUTOMATIC LAYERING

- Creation of the additional layers at all existing restored steps
- Creation of restoration steps at new layers' deposition age

MESHING

- Instantaneous meshing based on section topology
- Unstructured mesh precisely representing the geometry
- Continuously deformed through geological time
- User-defined grid refinement
- Automated mesh QC and feedback
- Manual edition and fixing if necessary

Results Analysis

RESTORATION QC

- Surface variations
- Length variations
- Contacts preservation

KINEMATICS

- Full kinematic scenarios
- Automated export of key steps to Microsoft Powerpoint

MESH

- Topology preservation through time (horizons, faults, top and bottom boundaries)
- Lagrangian mesh continuously deformed
- Adapted to basin simulation

Integrated Link to TemisFlow™

- Automated initialization of a TemisFlow™ scenario for basin and petroleum system modeling with pre-defined:
    - Stratigraphy and ages
    - Lithologies (sedimentary and lithospheric)
    - Faults
    - Paleo-geometries
    - Erosions
    - Thickness variations
- Shared lithology library

Data Management

DATA IMPORT/EXPORT

The following formats are available:

- 2D section interpretations from 2D Move (*.ihf), LithoTect (*.txt 2D CGEOM and *.xml), Kine3D-2-XS (*.txt), and ASCII column based files (*.txt and *.prn)
- Lithology libraries in .xml and .ltds formats
- Templates, preferences and color scales from OpenFlow™
- Data exchange between OpenFlow Suite projects

DATABASE

- MySQL or Oracle database
- Improved data security and integrity, reduced data storage
- User and project administration

OTHER PLATFORM FACILITIES

- Colorscale & unit system management
- Online & contextual Help

System Requirements

- **Operating Systems**:
    - Supported on Windows 10, Compatible with Windows 11
    - Linux Red Hat 7 and Red Hat 8 for calculators only (unavailable GUI)
- **RAM**: 48 Gb or more recommended, 32Gb minimum
- **Minimum free disk space**: 5 Gb (for installation files)
- **CPU**: x86-64 processors (Opteron, CoreDuo, Core2Duo, Xeon & EMT64, Nehalem, Westmere, Sandy Bridge, Core i3, i5, i7)
- **Dualcore or Quadcore**: 2 GHz or more recommended
- **Graphics board**: NVIDIA (except Quadro FX 1000, Quadro FX 3500, Quadro NVS 110 M, Quadro NVS 280 SD and NVS 300) with recent driver (at least OpenGL 3.3 -driver 330 or later)
- Openmotif rpm package must be installed on Linux
- **Database**: MySQL 5.5, 5.6.X (with X superior to 22), 5.7 or 8.0 and Oracle 12c, 18c or 19c
- FlexLM 11.16.2 server for licensing

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