



# IPM 13

## New Features and Software Enhancements

### **HARDLOCK 12**

### **IPM 13**

#### **GAP**

- Improvements in overall performance, parallelisation etc.
- External Equipment Interface
- Solver phase options
- Outflow well ports
- Bug fixes

#### **PROSPER**

- Gauges can now be specified as boundary conditions
- Improvements to the gradient calculation
  - Bifurcation possible
  - New results layout
  - Plotting improvements
- Advanced thermal model added allow interaction between strings to be captured
- Now possible to capture Joule-Thomson affects across valves
- Possible to now apply a fixed dP or valve model to gaslift valves
- ESP efficiency look up tables now added
- Tandem ESP motors now available
- Parallelisation now possible in System, Gradient and Inflow calculations
- Bug fixes

#### **RESOLVE**

##### Data Objects

- Added data science objects for R and Jupyter Python
- Added GIS and Mapping Tool objects for GAP model building
- Added RE-Studio Integration Reader and Viewer objects
- SciKit PCA object added for Machine Learning
- To allow Web Connectivity, the following objects were added/extended:
  - XML object added
  - Generic Web Client object added
  - Petroleum Experts Web Client object added
  - JSON object extended

- MOVE Engine allowing MOVE to run non-GUI

#### Other Enhancements

- Introduction of the Petroleum Experts Web Service
- Continued enhancement of the MOVE-REVEAL connection for advanced integration
- DataStores now support CSV formats
- Now possible to use structured JSON data for GAP model building
- Now possible to run IPM on the Schlumberger DELFI platform, where the IX and Eclipse drivers are integrated with ODRS
- Implementation of semi-dynamic clustering, with work towards fully elastic clustering
- A new plotting interface has been implemented
- Improvements made to the archiving process
- Extensive improvements to Visual Workflows in the domain of visualisation, exception handling and intellisense
- General bug fixes

#### MBAL

- Minor cosmetic changes
- Bug fixes

#### PVTp

- Ability to export and import wax related properties to and from IPM \*.prp file format
- Additional wax properties included
- Now possible to tune fluids to wax appearance and amount data
- Overall improvement to wax modelling
- Bug fixes

#### REVEAL

##### Calculation improvements:

- New linear solver default options implemented
- Updated the non-overlap parallel solver
- Added a GPU solver

##### Well modelling improvements:

- Gradual opening/closing of valves/chokes over an interval for transient modelling
- Can now add gauge depths to a well
- Ability to place the well within the reservoir graphical
- Screen/ICD velocity constraint added
- Orifices in annulus and second/coiled tubing added
- Transient 3-phase segregation model added
- Experimental transient dispersion limiting model added
- Transient max well time step added
- Transient calculations available for all pipe segments including completed pipes
- Can now schedule PI multipliers with respect to the original value
- Improved coupling of solids trapping and filtercake models for crossflowing wells

##### Fracture modelling improvements:

- Improved coupling to detailed wells for X-flow fracturing

- Improved stress calculation with vertical pinchouts within refinement
- Option to allow fracture cross flow for a no flow well
- Delaunay fracture gridding option added
- Absolute limits from linear fracture growth and shrinkage
- Acid fracturing enhancements

#### Water Chemistry improvements:

- Improved handling of redox reactions, for sulphate/sulphide with souring (pe tracking)
- Option to use new Phreeq 3.6.2 engine added
- H<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>, O<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub> gas equilibrium now possible

#### Coupling improvements:

- Poro- and thermos- stress reversibility now possible
- Stress tensor added for grid and true alignment
- Vertical K1C modifier added

#### Grid generation improvements:

- Tartan grid extended to set model size
- Actnum array added
- Improved handling of pinchouts and faults within refined regions
- Rock thermal expansion option added

#### Visualisation improvements:

- Slider bar added to move through time in plots
- Integrated vertical properties and delta for 3D visualisation
- New 2D plotting interface

#### Fault improvements:

- Faults defined by I,J column with width and permeability
- Point cloud fault properties, width, permeability, hanging and foot wall throw change added
- Interaction with MOVE extended

#### Relative Permeability improvements:

- Extrapolated Corey method
- Corey exponent endpoint scaling
- Changed definition of Corey krog endpoint

#### Miscellaneous improvements:

- Extra results added, e.g. 3d results, gauge results etc.
- New OpenServer commands added
- Simple Kriging and sequential Gaussian simulation now possible
- Updated validation and warnings/errors
- More general use of mask arrays for history matching
- Wormhole model added
- EOS modelling extended
- Bug fixes

## MOVE

MOVE 2022 is a part of the IPM 13 release:

- New option for deploying MOVE with the rest of IPM, or separately on its own.
- New option for installing the MOVE Tutorials and Tutorial examples.
- Important for API and workflows that utilise both RESOLVE and MOVE.

MOVE 2022 introduces new ability to create 3D GeoCellular Volumes

- Create 3D Grids as input for reservoir simulation (e.g. REVEAL)
- The creation method will honour Faults.
- New export Volume in REVEAL format
- Improved MOVE import and export to/from ECLIPSE format
- GeoCellular Volume Attributes are now saved in export formats

MOVE 2022 extends further the API for either RESOLVE or OPENSERVR

- More MOVE tools exposed to the API.

MOVE 2022 introduces a brand new RESOLVE Data Object (RDO), MOVE Engine:

- Access MOVE Data and operations – without GUI;
- Compliments the existing API.
- Improve performance and efficiency of RESOLVE workflows using MOVE.

Model Building improvements

- Resample Tool and Surface with Boundaries Tool

Improvements in 2D Kinematic Modelling

- Display of Thermal subsidence and burial history curves
- 2D Decompaction tool with polygons

Improvements in Fault Analysis

- Extract Vshale input from a GeoCellular Volume, instead of Wells.

MOVE links to Petrel and GST updated to support latest versions