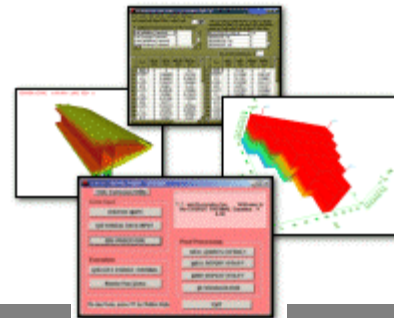


# EXOTHERM

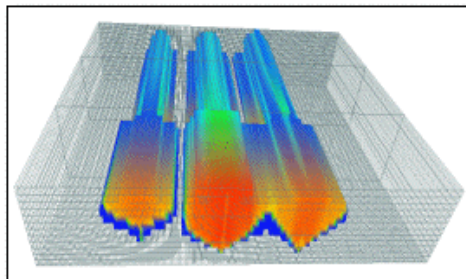
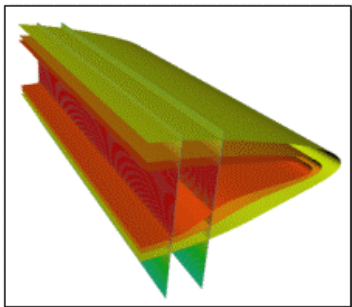
Thermal Reservoir Simulator for Microsoft Windows™

Designed for use with the Microsoft Windows 98, 2000 and XP™ operating systems:



## Simulator Features

- ▶ **Radial** and Cartesian Coordinates in 1, 2 and 3 dimensions. Local Grid Refinement.
- ▶ **Heat** transfer in reservoir and over/under burden
- ▶ **Fully** Implicit K-value Compositional Formulation. Any component can exist in any phase.
- ▶ **Dual** Porosity / Dual permeability for Naturally Fractured Reservoirs.
- ▶ **Arbitrary** Neighbour Connections.
- ▶ **Fast**, user independent, iterative sparse matrix solver.
- ▶ **Optional** Nine Point Transmissibilities.
- ▶ **Metric** or Field Units.
- ▶ **Optional** calendar dates.
- ▶ **Vertical**, inclined, or horizontal wells. Optional source/sink or discretized wellbores. Rigorous multiphase flow calculations, showing steam quality with time.



- ▶ **Multiple** relative permeability sets. Temperature dependent end points. Areally variable fluid contacts, critical and residual saturations. Relative permeability hysteresis.
- ▶ **Simultaneous** well constraints for oil, gas, water, liquid, and steam rates, flowing bottom hole pressure, fully coupled multiphase pressure loss correlations for horizontal wells.
- ▶ **Gathering** Centres for well grouping. Constraints for production, injection, steam-oil ratios.
- ▶ **Production** temperature reporting (mixed wellbore conditions)
- ▶ **Pressure** and temperature dependent porosities and transmissibilities

## Simulator Applications

- ▶ **Thermal** recovery processes such as Steam Assisted Gravity Drainage, cyclic steam stimulation, steamflood.
- ▶ **Combustion** processes with chemical reactions. Simulate Thai process.
- ▶ **Full** Field, 3 dimensional simulation with multiple wells, pattern elements, or individual well performance predictions.
- ▶ **Horizontal** well appraisal.
- ▶ **Transient** discretized well bore simulations with multiphase pressure loss correlations. Wellbore design from well head to toe.

*Full Featured*

*Affordable*

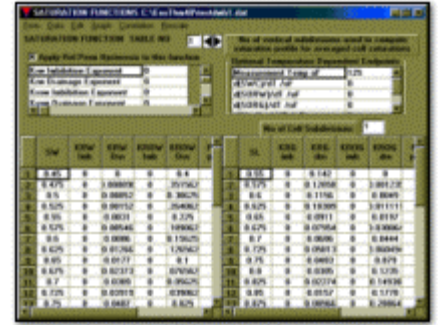
*3-D Graphics*

*User Friendly*

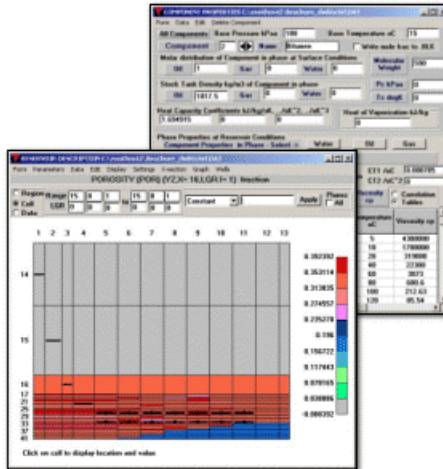
*Superior Support*

- ▶ **Graphical User Interface.** Point and click with mouse to select options from command buttons, drop down menus, and check boxes.
- ▶ **Full On-line Help.** Obtain detailed description of menu items for each displayed form. Search Help file for topics or keywords.
- ▶ **Spreadsheet-type** data entry forms with inline data cell editing. Edit functions such as copy and paste, fill down, fill right, and undo.
- ▶ **No more keywords or syntax problems.**
- ▶ **Exchange** data with other Microsoft Windows™ applications. Cut and paste customized well summaries to wordprocessors for reports. Copy tabular data to spreadsheet programs for customized manipulation and paste back.
- ▶ **Run** the simulator in the background when other time critical tasks need to be done. Monitor flood fronts and performance of wells with post processing programs such as Grid Display, Well Charts and Well Report while the run is still processing. Stack up multiple cases to run at specific times for batch processing.
- ▶ **Output** to any Microsoft Windows™ supported printer or plotter (colour or b/w).

- ▶ **Create**, view and edit Data Sets with Graphical Interface with full Microsoft Windows™ features (menus, tabular entry, mouse control and data exchange).
- ▶ **Full** error checking. Display tabular values graphically. Optional calendar dates.
- ▶ **PVT** properties entered in blackoil format or compositional.
- ▶ **Correlations** for PVT and Saturation Functions.
- ▶ **Enter** grid cell data directly from digitized maps.



- ▶ **Interactively build** grid over digitized maps. Rotate, stretch or move grid lines with mouse. Infill digitized layer maps to obtain grid cell values.
- ▶ **Modify** grid cell values with edit functions (add, multiply, constant). Enter complex formulae to compute grid cell values from other grid cell values.
- ▶ **Color** cells with user palette. Obtain shaded contours of grid cell values. Superimpose digitized maps. Display xy, xz, yz cross-sections.
- ▶ **Discretized** well bore data entry.
- ▶ **Enter** well production/injection data on a well by well basis, i.e. as you get it from database.
- ▶ **Only** one well type necessary. The same well can be used for injection and production at different times.



## Well Charts

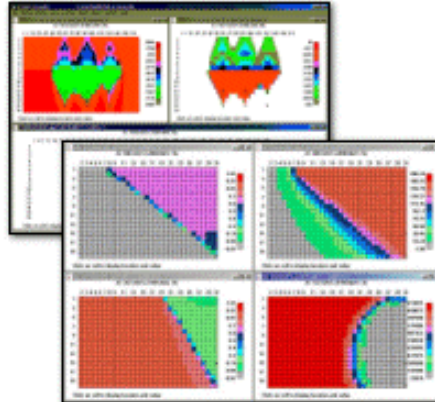
▶ **Produces** graphs of well performance from simulation cases, production history data and pressure history, well automatic update as simulator.



- ▶ **Quickly** generate graphs from standard default graph types.
- ▶ **Select** from over 40 series options such as rates, ratios, cumulatives, well pressures, % recoveries.
- ▶ **Compare** simulated with historical values. Compare many wells on the same graph. Compare several runs on one graph. Group wells from a series.
- ▶ **Plot** any series on X, left Y and right Y axes with appropriate scaling. Plot as many as 30 series on a graph.
- ▶ **Annotate**, change fonts, log or linear scales, automatic or custom linestyle and colours, tick marks, grid lines.
- ▶ **Use** the template facility to build graphs for all wells from one well graph.
- ▶ **Plot/print** up to 4 graphs on the same page.

## Grid Display Utility

- ▶ **View** results of simulation. Display colour maps of grid cell values for:
  - ▶ **Initial** values of Porosity, Permeability, Depth, Thickness, Pore volumes.
  - ▶ **Time** dependent values of temperature, pressure; oil, gas and water saturations; ternary phase saturations; volumes of fluids-in-place; displaceable volumes of oil.
- ▶ **Shaded** contours of cell values.
- ▶ **XY, XZ, YZ** cross-sections. Group layer values into single zone values for display.
- ▶ **Locally** refined grid cell values. Cross-sections of locally refined cells.
- ▶ **Display** well locations and well names as a function of time.
- ▶ **Zoom** / Unzoom option.



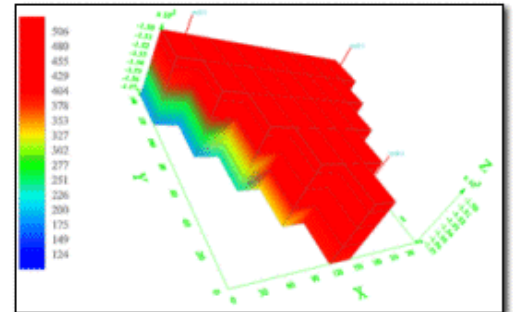
- ▶ **Cell** value enquiry, text values displayed in cells in selected font.
- ▶ **Superimpose** digitized maps over computed grid cell values.
- ▶ **Start**, stop and resume animation of cell values with time.
- ▶ **For** user defined regions, display oil-in-place, average pressure, temperature, saturation, energy production rates and cumulatives, migration and percent recovery.
- ▶ **Graph** cross-section values or cell values with time.
- ▶ **Show** multiple views of the same model, for different times/parameters and/or cross-sections (layers).

## Well Report Utility

- ▶ **Customize** well summary reports from simulation runs.
- ▶ **Choose** from over 30 report items including injected or produced SOR, heat injected and produced, mixed wellbore conditions.
- ▶ **Create** and save user defined tabular format.
- ▶ **Report** by well for all times.
- ▶ **Report** at any time for any or all wells and parameters (by completion cell if desired).
- ▶ **Immediately** graph current report. User definable placement of series on axes.
- ▶ **Summaries** for groups of wells, and total field.
- ▶ **Print** or copy and paste reports to a spreadsheet or wordprocessor.

## 3 Dimensional Visualization

- ▶ **Stereo** visualization with additional eyeglass and graphics card hardware.
- ▶ **Display** 3D views of the reservoir for parameters such as porosity, permeability, time dependent values of pressure, fluid saturations, temperature, fluid volumes in place.
- ▶ **Pan**, rotate, zoom the 3D views. Show multiple cross-sections and isosurfaces. Interrogate cell values.
- ▶ **Clip** layers, rows and columns. Animate the clip to walk through the reservoir.
- ▶ **Print** or export image to bitmap files for import to other graphical program.
- ▶ **Alter** the 3D view by cutouts, shifting, spreading out or separating layers or cross-sections. Apply clipping or change the visible range of layers and cross-sections.
- ▶ **Start**, stop and resume animation of all the views. Show well locations as they are drilled. Make cells visible only if they are in a specified data range and animate with time.



## Price

- ▶ **EXOTHERM** is priced based on the number of active grid cells. Lease only the version that will fit your reservoir problems, and upgrade for the difference in price when necessary.

## Requirements

- ▶ **Pentium** processor
- ▶ 2 Mb RAM for each 1000 grid cells
- ▶ 200+ MbHDD

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