



ORIGINPRO[®] 2020

Datenanalyse- und Grafiksoftware

Feature List

(Updated for version **2020** on Oct 22, 2019)

64 Bit Support

Overview

- Native 64-bit and 32-bit applications
- Import ASCII files bigger than 4GB with 64-bit application
- Memory capacity limited only by installed hardware with 64-bit application

Unicode (UTF-8) Support

Overview

- Use Unicode characters in Long Names for worksheets, graph pages and other Origin window types
- Enter Unicode text in worksheet cells and metadata area
- Type code and press ALT+X to insert character
- Unicode (UTF-8 Encoded) Text Strings Support in LabTalk and OriginC

Start Menu with Search

Overview

- View recently opened Origin Projects, other files, menus and Apps
- Type keywords or phrases into edit box to search within Origin

Apps in Origin

Overview

- Find and install Apps from File Exchange area of the OriginLab website
- Use Apps Gallery window in Origin to launch and manage Apps
- App Center for easy installation and update of Apps
- Origin menu indicates when updated versions of installed Apps are available

- Several pre-installed Apps for publishing and curve fitting

Large Data Support

Overview

- Multi-threaded ASCII import enables fast import of large text files
- Density dots and Color dots for large data
- Fast scatter plots for large data
- Fast speed for colormap contour even without speed mode
- Fast Data Highlighting on graph with large data
- Dense Data Mode on page level enables fast redrawing
- Fast cell calculation and result sheet recalculation

Importing Data

Overview

- Drag-and-drop import of data and images
- Data Connector maintain connection with web file or local file as data source (CSV, HTML, JSON, MS Excel, Origin Project and more)
- Import data from an Origin project file
- Query and pull columns from Origin project files (*.OPJU)
- Save import settings to a worksheet or external files for repeated use
- Use saved settings to re-import files with a single click
- Run script after each file or all files are imported
- Import Wizard with visual feedback
- Handle non-standard files by programming
- Import multiple images into the same matrix sheet
- Customize File:Import menu by specifying which import types to display
- Extraction of file metadata for use in subsequent analysis or graphing operations

- Set Origin as default program to open desired data files
- Import specified column/rows for ASCII, Excel and CSV
- Undo import of ASCII, Excel and CSV

ASCII Data

- Unicode support
- Support for delimited and fixed formats
- Multiple delimiter support
- Separate header and data lines
- Extract Long Name and Units on same header line during import
- Extract metadata from filenames and header lines
- Control treatment of leading zeros, quotation marks, missing data points and alternate numeric separators
- Partial data import support
- Transpose on import
- Many date and time formats recognized
- Support for categorical data
- Source File header row to show imported file name

Third-Party Formats

- Binary and instrument formats:
 - CDF, HDF5
 - Data Translation (DCF, HPF)
 - EarthProbe (EPA)
 - Famos (DAT, RAW)
 - ETAS INCA MDF (DAT, MDF)
 - Heka (DAT)
 - JCAMP-DX (DX, DX1, JDX, JCM)
 - NetCDF (NC)
 - NI DIAdem (DAT)
 - NI TDM (TDM)
 - pCLAMP (ABF, DAT)
 - Princeton Instruments (SPE)
 - Somat SIE (SIE)
 - Sound (WAV)
 - Thermo (SPC, CGM)
 - EDF (EDF, BDF)
 - MZXML

- Software-specific formats:
 - IgorPro (PXP, IBW)
 - KaleidaGraph (QDA)
 - MATLAB (Mat)
 - MATLAB with structured data (Mat)
 - Minitab (MTW, MPJ)
 - Excel (XLS, XLSX, XLSM)
 - TDMS (LabVIEW 2009)
 - GraphPad Prism
 - SPSS(SAV)
 - SAS (SAS7BDAT)
 - Tektronix (ISF)
 - BRUKER OPUS

Image Formats

- Support formats: PNG, GIF, TIF, JPG, BMP, TGA, PCX, PSD, WMF (Convert to Raster)

Database Access

- Graphically construct SQL queries, save named SQL query with workbook or to disk
- Define SQL queries in Query Editor, which supports syntax coloring and LabTalk substitution
- Database connecting interface: ADO and ODBC

Digitizer

- Digitize graphs (get data values for points) that exist as images
- Pre-processing of images: rotate, remove gridlines, clear background
- Supported coordinate systems: Cartesian, Polar, Ternary
- Auto trace lines: by point, by grids, by area
- Add labels to picked points

Collaboration & Connectivity

Collaboration

- Share files such as templates, Themes, custom tools, using group folder (easily controlled within multiple groups)
- Share files using user files folder across multiple computers
- Pack selected files including toolbars and custom code to external file (OPX) for sharing
- Export toolbar and floating window configuration to a file
- Option to switch language of interface

Connectivity

- Import or directly open Excel 97-2007 workbooks (XLS, XLSX)
- Drag-and-drop data from an Excel book opened in Origin directly into a graph
- Copy-and-paste Origin graphs directly into MS Word and PowerPoint
- Send data directly to Origin from LabVIEW with Origin Sub Vi's; send results back to LabVIEW as well
- MATLAB Console, R/Rserve Console, and Mathematica Link allow data exchange with Origin
- Use Origin as an Automation (COM) Server to send commands and exchange data from any COM-enabled client application

Exporting and Presentation

Exporting Graphs

- Creating movies from Origin graph windows using GUI tool or script
- Raster formats: BMP, GIF, JPG, PCX, PNG, PSD, TGA, TIF
- Vector formats: AI, CGM, DXF, EMF, EPS, PDF, WMF
- Export dialog with settings for precise width/height and resolution (DPI)
- Interactively select area of Graph Page for export or to copy-paste to other applications
- Save graph export settings as Theme for repeated use
- Copy graphs or layout pages to clipboard and paste to other applications such as Microsoft Word or PowerPoint
- Copy graphs and paste directly to online documentation tools such as Confluence page
- Paste link using Origin as an OLE 2 server
- Fit layers to page enables easy resizing of graphs for publishing
- Use layout page or worksheet with cell formatting to arrange multiple graphs and numeric data tables
- Batch print multiple graphs
- Master page for global annotation of graphs
- Transparency support for EPS files using raster elements
- Transparency support for PDF files

Exporting Data

- Export data to ASCII file with options to append to, or replace existing files
- Export multi-sheet workbook as Excel file
- Print entire worksheet/matrix sheet or a selected range
- Batch print multiple windows
- Export workbook as NI TDM/TDMS file
- Export worksheet data as wave file
- Export matrix as ASCII or image file
- Print Preview support for multiple windows
- Copy and paste data as HTML/EMF table to other applications such as MS Word

Exporting Reports

- Export a report sheet as a multi-page PDF document

Exporting Images

- Raster formats supported: BMP, GIF, JPG, PCX, PNG, PSD, TGA, TIF

Presentation

- Slide-show of selected, all, or dependent graphs
- Export selected or all graphs directly to MS PowerPoint with specific slide layout and style
- Layout page to flexibly arrange graph/sheet/objects

Data Management

User Interface

- Learning Center dialog, including keyword search of sample graphs, helps users get started with Origin
- New Workbook dialog with build-in templates, plus ability to add user-template and set as default template
- Auto-hide Project Explorer and other dockable windows
- Plot menu with appealing icons
- Show basic descriptive statistic results in status bar, with copy to Clipboard support
- Collapsible menu and context menus
- Customize toolbar style
- Automatic transfer of workspace layout and User Files from previous version
- Indicator to indicate active window
- Object Manager to makes it easy to manage plots on a graph and worksheets on a workbook
- Support copy/paste of folders and workbooks across Origin sessions



Origin Project File (OPJ, OPJU)

- Project File structure (OPJU) with significant improvement in file size
- OPJU enable preview and thumbnail views of Origin Graphs/Workbooks/Matrices in Windows Explorer and File open dialog
- Ideal for storing all of your data, graphs, and analyses
- Five page types for data storage and display: Workbooks, graphs, matrix books, layout pages, and notes windows
- Find metadata in project file
- Attach external files to a project
- Store analysis results in worksheets or the Results Log
- Support for auto-save for projects
- Individual backup file for each project for recovery
- Unsaved projects auto saved for 7 days, accessible from Origin Central
- Password protection of project files
- Audit log of project saves, with optional password protection
- Automatic audit log for all newly created projects
- Save project without data
- Duplicate workbook or project without data
- Properties dialog for folders or windows

Project Explorer

- View and organize the contents of your Origin project (OPJ) using an interface similar to Windows Explorer
- Organize and quickly access your work using hierarchical user-defined folders
- Create a favorites folder with shortcuts to important workbooks, graphs and notes
- Graph/workbook/matrix preview and folder/window tooltip on hover
- View windows in details, list, small, large and extra-large icons in Project Explorer
- In-place edit of comments, long name, short name

Workbooks & Worksheets

Data Storage

- Password protection for workbook/project
- Multiple worksheets per workbook
- Multiple matrix sheets per matrix book, and multiple matrix objects per matrix sheet
- Workbook size: Up to 1024 sheets, and 65,527 columns * 1 row or 90 million rows * 1 column per sheet

- Matrix size: Up to 90 million cells, depending on data type (note that memory limitations may prevent these values from being reached)
- Column-oriented data type can be general or free form (cells can hold both numbers and text), or can be fixed-sized array (numeric cells)
- Numeric cells can be time, date, or basic numeric types, including 4- or 8-byte float; 1-, 2-, and 4-byte, signed or unsigned integer; or 16-byte complex numbers; can also customize display format
- Displaying numeric values in fractions, percents, numeric units, pi, km, hex numbers etc.
- Global setting for default significant or decimal digits
- Worksheet acts as Virtual Matrix with nonlinear X/Y spacing supporting 3D graphing and analysis operations
- Virtual Matrix manager to organize Virtual Matrices

Data Organization and Metadata Support

- Column List View for worksheet to display only a column list
- Reserved rows for long name, units, comments, sampling interval, sparklines, column formula, column filter and user-defined parameters
- Sparklines on column headers display small graph of data for quick inspection (3 plots - line/box/histogram; 2 scale types - linear/log10)
- Easy customization of categorical data (sort, re-order, add or delete) and use it to control category entries in graphs/analysis
- Workbook organizer shows file import info including variables extracted from file header
- Manually or programmatically add metadata to workbook
- Add LaTeX equations to the worksheet metadata area and use them in graph axis titles and legends
- Sampling interval support for columns
- Drag range selection to auto fill data by extending or duplicating existing data
- Lock Icon on output columns to indicate recalculate mode for operations
- Support long name, units, comments and user-defined parameters for matrices
- Thumbnail on matrix to display small image of matrix data for quick inspection
- Drag and drop sheets to remove from, or add to, workbooks and matrix books
- Click-and-drag to adjust row height and column width in worksheets and matrices
- Extract worksheet data by condition



- Horizontal and vertical dividers for simultaneous viewing of different parts of worksheet
- Hide/Unhide columns and rows in worksheets
- Navigate Worksheets dialog for managing worksheets in the workbook
- Support adding long name and comments to worksheets
- Short name, long name and comments will be displayed as tooltip when hovering over worksheet tab
- Floating graphs in worksheet
- Add graph or notes window as sheet
- Treat missing values as blank in worksheet

Formatting

- Support for rich text cell formatting
- Conditional Formatting: highlight cells by rules, highlight duplicate cells, and heatmap
- Unicode support for non-English characters
- Character Map dialog to find and insert Unicode characters in cells
- Embed graphs, layout, images, and notes in worksheet cells
- Image pop up for embedded graphs and images in worksheet cells and header rows
- Merge cells to flexibly arrange and present graphs and numeric data
- Insert links in worksheet cells to other cells, including cells from analysis report sheets
- Auto-size option for worksheet and matrix columns
- Save formatting of worksheet and matrix sheets to Theme/template for repeat use
- New Worksheet/Matrix dialog to specify format/Themes when creating new worksheet/matrix
- Set format of selected cells by condition

Graphs

Overview

- Pop-up mini toolbars provide access to common graphing customization options
- Quick access to all built-in graph types from toolbars
- Page, Layer, Plot hierarchy to organize data plot
- Plot with graph templates and organize templates using Template Library
- Copy-paste data plots between graph layers
- Batch-plotting to duplicate graphs using data from different columns/sheets/books for 2D, 3D and contour graphs

- Smart plotting with cloneable graph templates, allowing for one-click creation of graphs from sheets with a similar data structure
- Plot Setup dialog for quick plotting of data from multiple worksheets, common columns, Excel workbook and matrix book
- Create custom multi-panel plots
- Merge multiple graphs with preview
- Drag-and-drop data columns into graph
- Plot same column multiple times, such as different ranges, in a single graph layer
- Speed mode control for plotting large datasets, easily toggle for all layers by a button
- Color scale for color mapped plots with flexibility to customize ticks, levels, labels, layout, title.etc
- Bubble scale for size-mapped 2D plots with linear or nested layout. Anti-aliasing in screen display
- Isometric – link axis length to scale by X/Y ratio
- Select and customize single data points in a plot
- Quick edit graph element style with toolbars; In depth editing of graph element details with Plot Details dialog
- Easy color control to pick more colors and define custom colors
- Custom color palettes and incrementing symbol lists for color map and grouped data plot
- Symbol size increment for each plot in group
- Customize the format increment lists and color palettes for grouped data
- Introduce subgrouping for grouped data
- Full-screen view for graphs, maintaining aspect ratio
 - or 3D plot from worksheet data (virtual matrix, with numeric or text XY)
- Layer Content dialog for easy adding, removing, grouping, ungrouping and reordering of data plots
- Show and hide layer with the layer icon context menu
- Easily stamp windows with project filename using Project Path button
- Disconnect graph page from active printer
- Hover on data plot to show tooltip of source data
- Pick data points from graph

2D Graphs

- Line – 12 line styles incl. segmented and spline
- Scatter - built-in or user-defined symbols
- Line and Symbol - 4 types
- Density Dots and Color Dots for large data
- Row-wise line series with error bars



- Column/Bar - 10 types including grouped column plots from indexed data and grouped stacked column plots
- Control column/bar width using dataset
- Normalize stacked column/bars to 100%
- Bridge Chart (McKinsey-Style Waterfall)
- Area - 9 fill area methods
- Bubble/Color Mapped - 3 types
- Multiple Panel - 6 types or create your own
- Multiple Axes Plot - 6 types or create your own
- Trellis Plot
- Cluster plot
- Pie and Donut Charts
- Kite Diagram
- Polar (r, theta) or (theta, r)
- Ternary Diagram, with scale customization and optional axes direction
- Smith® Chart
- Piper Diagram
- Stock Charts: High Low Close, Japanese Candlestick, OHLC Bar Chart, OHLC-Volume
- 2D Vector - 2 types: XYXY and X, Y, Angle, Magnitude
- Stacked lines by Y offsets with customizable offsets and option of grouped lines
- Windrose: raw or binned data
- Radar/Spider Chart
- 2D Function graphs and 2D Parametric Function graphs for plotting mathematical equations

3D Graphs

- Edit data range in 3D graph
- 2D symbol for 3D scatter
- 3D ternary surface/scatter
- Tetrahedral Scatters/Lines/Line+Symbols
- XYZ Scatter/Trajectory with optional drop-lines/projections/error bars
- 3D bars with data labels
- XYZ Bars with optional error bars
- XYY Bars, Ribbons, Walls, and Waterfall
- 3D stacked bars
- Normalize 3D stacked column/bars to 100% 3D OpenGL-based waterfall plots
- Surface plot from both XYZ and matrix data
- Color map surface with optional projected contour
- Link contour line color to colormap
- Wire Frame and Wire Surface
- Surface with constant slices in X or Y direction

- Pie Chart
- 3D Vector – 2 types: XYZ-XYZ and XYZ-dxdydz
- Stretch any 3D graph axis to change aspect ratio
- Shearing or skewing of graph axes
- Rotate 3D plots graphically by clicking and dragging
- Missing value and grid-line skip support for 3D surface
- Color mapping of 3D bar plots using Z values
- Major and minor level support for 3D surface plots
- Multiple intersecting surfaces supported
- 4D Surface Plot with Custom Boundary
- Z-axis, including nonlinear scales, for waterfall plots
- Y- and Z-value color map support for waterfall plots
- Connect control in 3D waterfall which enables smooth waterfall lines
- 3D parametric surface
- 3D Function graphs and 3D Parametric Function graphs for plotting mathematical equations

Contour Graphs

- Create contour plot directly from XYZ data using triangulation
- Contour with categorical Z values
- Ternary contour
- Polar contour
- Color filled contour
- Black and white contour with lines and labels
- Gray scale map
- Heatmap (with/without labels) from XY/XYZ, virtual matrix and matrix
- Split Heatmap
- Custom level formatting using color, contour lines and labels
- Specify label prefix and/or suffix
- Set label decimal points
- Include color scale legend
- Individual contour line and level control
- Color palette support
- Control the display of missing values in contour
- Ignore Z missing values in XYZ contour
- Specify custom boundary for contour graphs using datasets and separately customize style of boundary lines
- Extract data points or show polygon area for any or all contour lines
- Generate grid from triangulation of contour plot



Statistics Graphs

- Probability plots including Weibull distribution
- Q-Q Plot
- Interval Plot
- Parallel Plot
- Sankey Diagram
- Alluvial Graph
- Pareto chart with option to combine smaller values
- Rug Plot
- Violin Plot
- Statistics Bar options for mean, max, sum, etc.
- Box and/or column scatter (opt to jitter data points)
- Grouped box plot – indexed or raw data
- Rectangular/diamond/i-shaped/notched box
- Box width/position controlled by dataset
- Display mean/median lines, percentile points in box charts
- Connect mean points, data points or other percentiles in box charts
- Individual control for whiskers, caps, median, mean and distribution curve in box plots
- Show outliers in box chart and display them in line
- Histogram, Stacked Histograms, and Histogram + Probabilities
- Scatter plot with marginal histogram or box chart
- Double Y Box Chart
- Control the number of bins or bin sizes for histograms
- Go to the binned data with a button in the Plot Details dialog box
- Checkbox to scale distribution curve by % of tallest bar for histogram plot
- Output distribution curve data to bin worksheet for histogram plot
- Label with bin counts, percentages, or both for histogram plot
- Stacked histogram
- 2D Kernel Density Plot
- Scatter Matrix (Histogram/Box chart in diagonal cells, Linear fit, R-square, confidence ellipse options)
- QC charts
- Optional distribution curves
- Before-After plot
- Population Pyramid
- Vertical/Horizontal/Circular Dendrogram

Image Graphs

- Image graph
- Profile tools: image/contour profile

Customizing Graphs

Graph Themes

- Copy and paste the format of one graph or element onto another graph or element
- Save a collection of formatting elements as a graph Theme
- Set system Theme to apply desired settings to all newly created graphs

Data Plot Color

- Independently set color for page, axes, labels, symbols, lines, area or bar fill
- Independent custom color support for all properties
- Color-mapped or color/shape/interior-indexed symbol
- Customizable increment list for color/shape/interior indexed symbol
- Color stretching for grouped data plots
- Apply built-in/user-defined color palettes
- Categorical data support for symbol color
- Color scale legends
- RGB color settings
- Labels on color scale legend can be shown on major levels or by increments
- Transparency and gradient fill control for graph objects

Data Plot Labels

- Auto-positioning of data labels with leader lines to data points
- Data labeling on specific indices/points, plus flexible label format controls such as displaying numbers in percent, fractions etc.
- Add or modify title text for layers
- Worksheet parameter row for annotating each curve in 2D Waterfall plot
- Associate dataset with data plot points, X, or Y axis
- Graphically attach text labels to individual data points
- Control color, font type, style, size, rotation, offset, background, and justification
- Tool to annotate a specific data point
- Label with leader lines for Pie Chart
- Labels for 2D Vector Plot
- Total Label on 2D/3D Stacked Column/Bar Chart



Line Styles

- Data point connection types include: straight, b-spline, spline, step (horizontal, vertical, center), Bezier, 2-point segment, 3-point segment, solid, dashed, dotted, Akima, modified Bezier
- Compound line style
- Customize line style for groups of data plots
- Customize dash and dot definitions (point values for widths)
- Masking support in line plots

Symbols

- Symbol size in X axis units
- Circle symbol size based on square, diameter or area
- Expanded set of over 100 built-in symbols
- Create custom symbols from bitmaps
- Offset plotting of duplicate points
- Categorical data support
- Color-mapped, as well as indexed symbol color/shape/size - up to 8 dimensions
- Custom symbol lists for grouped data plots
- Individual symbol edit control, with display in legend for 2D graphs

Fill Pattern

- Over 100 built-in fill pattern types, including standard geology patterns
- Option to add user-defined fill patterns

Plot Modifiers

- Customize plot attributes by modifier columns in the worksheet to create 3, 4, 5 dimensional plot.
 - Symbol color, shape, size and interior
 - Line color, style and thickness
 - Fill color and pattern
 - Data label color
 - Angle and Magnitude of 2D Vector
 - Column and box chart width, box chart position
- For 3D colormap surface, set the color map by values of another matrix or Z column
- Use indexing, color map of arbitrary values, or specific RGB values to assign color
- Define the color, shape, style, pattern increment list
- Legend can be customized to indicate such information
- Save Match Modifier by column index, name, or other metadata properties in graph template

Text Labels and Legends

- Default legend for data plot using metadata from worksheet or custom format
- Legend for categorical values
- Point-by-point legend
- Legend for box chart components
- New legend for fill area plot
- Legend text color same as plot color
- Customize symbol properties in Legend, or add new customized symbol/line entries
- Hide legend entries for hidden plots or fitted curve
- Easily reverse legend order or drag and drop to arrange legend entries in multiple columns
- In-place editing of text labels with Character Map access, TrueType fonts, bold, underline, italic, Greek, super/subscript or both, increase/decrease size, rotate, date/time stamp
- Support multi-line spacing
- Easily insert import file header information and other metadata into text labels
- Add symbol shapes with the Origin TrueType font
- Unicode support for text labels
- Customize legend to show desired data such as long name, comments, book/sheet name, and/or user-defined parameters in a customized format
- Automatically create a single legend for all layers in a graph
- Update or reconstruct legend at layer or page level
- Legend displays individually edited data points
- Link to LabTalk variables and specify the level of % and \$ substitution in the Programming Control dialog for legends

Error Bars

- Display error bar as % of data, standard deviation, or from a dataset
- Asymmetric error bar support
- Specify X and/or Y and/or Z error bar
- Error bar support on 3D graphs
- Control error bar color, line width and cap width
- Error bars can go up to or through symbols
- Set as absolute or relative error bar
- Skip points allowed for error bars
- Connect error bars with lines and fill the area under the lines
- Support scaling factor when adding error bars to graph using standard deviation of data



- Support for adding error bar to graph using square root of data
- Auto update of error bar columns when source data changes

Axes

- Apply axis settings to other axes or customize multiple axes together
- Double-log reciprocal axis scale, $\ln(-\ln(1-x))$, for Weibull plot
- Custom color support for axes and grid Lines
- Technical types: Linear, log10, probability, probit, reciprocal, offset reciprocal, logit, ln, log2, polar, Smith®, double-log reciprocal ($\ln(-\ln(1-x))$)
- Discrete axis scale type to support skipping weekend and holidays in financial plots
- Scale options: set rescale mode to normal, auto, or fixed from/to; specify increment, # of major ticks, # of minor ticks, first tick; reverse axis scales; user-defined axis scale type
- Control color, line style, and thickness
- Axis titles use long name and units from worksheet
- Options of axis title to be in the beginning/middle/end of axis
- Offset Axes - Multiple based on percent or axis position
- Grid Lines: Control color, line style, thickness, and density of major and minor grid lines for X, Y, and Z axes
- Multiple reference lines and shading between, in 2D graphs
- Add Reference Lines using statistical functions or custom expression
- Multiple axis breaks and individual control for each break
- Axis Break: Define gap, break region, break position along axis, scale type and increment before/after break, supports proportional unit for each segment
- Frame Options: 2D or 3D axis graph page
- Display layer icons on visible axes for each layer
- Add axis scrollbar to zoom or pan graph
- Manually specify tick marks and tick labels
- Multiple Y axes customization
- Flexible ternary scale
- Zoom or scroll in both X and Y inside graph layer using keyboard or mouse
- Zoom preview of fitted curve and residual plots in NLFit dialog
- Supporting for arbitrary zero and direction (CW/CCW) for polar graphs

- Support setting additional line values to plot column/bar from non-zero baseline
- Arrows at Axis begin or end, can be put outside of layer frame

Layers

- Up to 1024 layers per page
- Align and size multiple layers and text using Object Edit toolbar
- Customize properties across graph layers
- Support for naming layers
- Merge multiple graph pages (select graphs using Graph Browser)
- Add and arrange multiple layers using Layer Management dialog
- Create inset layers
- Link axes: specify formula for relationship
- Align layers at specified value
- Set layer width or height by common scale for multiple layers
- Support layer title

Tick Labels

- Basic Types: numeric, text from dataset, time (includes IRIG), date, month, day of week, column headings, indexed from dataset, categorical (binned text data)
- Special Types: Specify a user-defined formula or draw from a column of values
- Major and minor tick labels by count, increment, dataset, space separated list, or column label rows
- Minor tick labels display only at specified indices
- Axis tick label table support
- Leader lines for special tick labels
- Control the direction (in, out, both, none) and length of major and minor tick marks for X, Y, and Z axes
- Control color, font, size, number of decimal places, rotation, offset, display of individual special tick labels (first, last, and custom)
- Align, rotate, offset, show/hide
- Wrap text in tick labels
- Include minor tick labels
- Apply a divide by factor
- Include a prefix and suffix
- Include plus and minus signs
- In-plane axis title and tick labels for 3D graphs



Data Analysis

Overview

- Standardized analysis tools with tree structure for settings
- Analysis markers to indicate range used for analysis
- Preview of results in most analysis dialogs
- Analysis report sheets with collapsible tables
- Ignore hidden columns/plots from analysis

Recalculation

- Manually or automatically update the results of any previously run analysis operation when data or parameters change
- Globally change the default recalculation mode for all analysis dialogs

Analysis Themes

- Save settings of analysis dialogs to Theme for repeat use
- Access saved analysis Themes from fly-out menu or script

Analysis Templates

- Save workbook as Analysis Template™, with desired analysis routines and custom settings, including custom report sheets to present results
- HTML/Markdown-based reports for repeat Analysis and publishing
- Re-use Analysis Template™ manually or in Batch Processing mode, to analyze multiple files or datasets

Analysis Results

- Keep analysis results organized in same workbook as source data
- Embed graphs and analysis to create custom reports
- Create separate reports per dataset for same analysis routine, or combine in one results sheet
- Report results to Results Log to establish analysis history
- Residual Analysis (linear, polynomial, multiple regression, nonlinear fitting)- 4 residual types (regular, standardized, Studentized, Studentized deleted) and 6 plot types
- Customize default digits for analysis output in each tool
- Separate numeric display for analysis report sheets
- Adjust footnote size in built-in analysis report

Graph Annotation

- Add text, including plain text or text from data or metadata with rich text format
- ALT + drag a dynamic label object from point to point
- Add graphic objects such as line, polyline, freehand draw tool, arrows, circle, oval, square, rectangle, polygon, freehand region, etc.
- Add special characters, superscript, and subscript notation
- Add equations to your graph (MathType or LaTeX App)
- Add an image from external file
- Add tables to graphs, table cells may be linked to other worksheet and report cells
- Decimal separator for labels and annotations can be controlled at Graph Page level
- Copy-paste cells from a worksheet to create a table
- Add XY Scaler, asterisk brackets, date/time stamp, and project path

Editing Objects

- Line types: straight, poly line, freehand
- Line styles: solid, dashed, dot
- Begin/end arrow control
- Shapes: rectangle, ellipse, polygon, region
- Fill types: hollow, fill color, fill pattern
- Transparency support for shapes and lines
- Resize/rotate/skew all lines/shapes
- Align, evenly distribute, send to front/back, group/ungroup objects
- Manually move 3D planes along the axis direction
- Ability to shift 3D plot in Z direction using percent of scale range
- Lighting effect for 3D surface and wall plot
- Change light source direction in 3D graph by pressing S key and dragging mouse
- Mesh for 3D surface
- Move, rotate and resize 3D graphs in an intuitive way
- Control alignment of ticks, tick labels and axis titles
- Leader line for data labeling in 3D graphs
- Show symbol in 3D XYY Waterfall, Walls and Ribbons
- Different bar shapes are supported for 3D bars

Batch Processing

- Batch processing data from different data source such as data files, XY ranges, XYZ ranges, worksheets, columns and matrices
- Clone current project for repeat analysis
- Batch processing with summary report using Analysis Templates™
- Link analysis template to a Microsoft Word template for report creation, and combine all word files into one after batch processing
- Import multiple files into sequential worksheets in your Analysis Template™
- Execute LabTalk script before or after each file, or at end of the batch process
- Block recalculation for operation when click Recalculate button
- Batch peak analysis of multiple datasets using Theme (PRO)
- Repeat analysis on all plots in graph, or all columns in worksheet
- “Copy-paste” fitting operations to selected curves
- Copy - paste formula and labels between columns
- Generate gadget output for all data plots in the graph
- Clone workbook/worksheet during import for batch processing
- Include graph images in Summary sheet and ability to recreate workbook for specific file entries.

Data Exploration

- Data Point Tooltip: Mouse over data points in graph to view useful information of data point
- Data Highlighter: Highlight data points in all open graph that originate from same row of worksheet
- Plot Highlighting: When selecting a plot in graph or in Object Manager, other plots fade away, corresponding worksheet column is highlighted
- Read data point coordinates, screen coordinates
- Inspect data point values/distances on/between curves using customizable data information display window and Cursor tool
- Graphically attach data labels with pinned connecting lines to individual data points
- Zoom in and pan simultaneously on graphs, worksheets, matrices and layouts
- Support Press Mouse Wheel in worksheet to scroll
- Launch separate graph with movable zoomed in region, supporting multiple overlapped layers
- Vertical and horizontal scroll bars to scroll and pan

- Move individual data points graphically
- Mask/Unmask data points on all or active data plot
- Data/Mask selection can be restricted to active plot or expanded to all plots within selection window
- Control display of masked data at Graph Page level
- Toolbar for data markers and locks

Data Manipulation

Setting Column/Cell Values

- Simple column formula notation is similar to Excel or Google Sheets
- Set single or multiple column formula
- Set cell formula for Data and Label Row cells. Extend by dragging. Fixed referencing supported.
- Directly edit column label row formula to set column values
- Function and syntax help on Status Bar and as Smart Hint
- Search and insert functions
- Large collection of categorized functions for setting column values, including date/time and string functions
- Easily define variables from meta data and other books and sheets for use in setting column values
- Auto update Set Column Values output when source data changes
- Set column values with LabTalk functions
- Subrange notation support in column formula
- Copy and paste column formula
- Color-pairing of formula parentheses
- Option to keep text when column values are transformed using formula
- Auto fill Column Label Row contents to the right

Worksheet

- Data filter to find and work with a subset of worksheet
- Save data filter info with the Copy Column To or Pivot Table operations
- Filter columns by label row
- Sort columns/worksheet, including support for nested sort
- Sort columns by column label row data
- Filter columns by Label Row
- Trim missing values in a worksheet
- Fill worksheet with row numbers, random numbers or uniform values/patterned data
- Remove duplicate data in a column
- Find and replace numeric and text values



- Unstack and stack worksheet columns using grouping variables
- Splitting columns by specified separator or interval
- Join multiple worksheets into a single worksheet with different conditions
- Pivot Table: Possible to have more than one source of column or row
- Data reduction: Remove duplicate values, remove every Nth point or remove points at a specified X increment (PRO). Reduce columns tool, remove/combine duplicated rows
- Extract worksheet data by specified condition or random sample
- Normalize data across multiple columns, or combine multiple dataset as one to normalize
- Merge XY data according to X values (worksheet only)
- Convert XYZ worksheet data to matrix using XYZ gridding: regular, sparse, random - Renka-Kline, Shepard, thin plate spline, kriging, 2D B-spline
- Convert worksheet data directly to matrix
- Convert matrix data to XYZ worksheet data
- Convert matrix data directly to worksheet
- Shrink and expand matrix
- Transpose data, and paste transpose
- Split a worksheet into multiple worksheets by number of columns/rows, or by column label information
- Ability to force Text & Numeric datasets to show numeric values as text elements

Curve

- Average multiple curves
- Translate curves (vertical/horizontal)
- Subtract straight line or reference data
- Change X, change Y or change worksheet data

Gadgets

- Gadgets for quick and easy exploratory analysis of a region of interest (ROI) on graphed data
- Results displayed on graph, and updated immediately when ROI object is moved
- Save custom settings as Theme for repeat use
- Batch analysis - apply analysis to all curves in a graph
- Output gadget results to a tree variable
- Toggle display of all ROI boxes with one button click

Quick Fit Gadget

- Easy fitting of graphed data using ROI
- Fit parameter values update as ROI is moved on graph
- Fit multiple datasets and send results to a consolidated report sheet
- Easily change fitting function and other settings
- Easily switch to NLFit for complete control
- Standard Error is reported for derived parameters

Other Gadgets

- 2D Integration Gadget (PRO): display 2D peak parameters with control of baseplane, results including the volume, surface area, FWHM for x and y, centroid for x and y within a ROI
- Statistics: Basic statistics, including display of mean and standard deviation lines inside ROI
- Integration: Peak parameters with choices for baseline, shading area under one or multiple curves
- Rise Time (PRO): Compute rise- or fall-time with options for setting high and low levels
- FFT: View frequency spectrum of data inside ROI in a separate window
- Cluster (PRO): Basic statistics and simple operations (copying, clearing, deleting and masking) to data points, setting color of selected region of plot, adding or clearing categories inside or outside ROI.
- Differentiation: Graph the desired order derivative curve of the input data set specified by a ROI
- Interpolation: Interpolate a dataset within an ROI using one of three methods (linear, cubic spline and cubic b-spline), and display the new curve
- Quick Peaks: Pick a peak within the ROI, integrate it, and perform fitting to it.
- Quick Sigmoidal Fit Gadget for fitting selected data using a sigmoidal function
- Vertical Cursor Gadget for reading X and Y coordinate values for data points on stacked panel plots, support to compare two cursors
- Intersection Gadget for calculating the intersection points of data plots in the input curves
- Curve Translate: Move the active curve vertically or horizontally. Image/Contour profile: profiling image or contour plot along horizontal, vertical or arbitrary directions

Curve Fitting

General Fitting Features

- Analysis report sheets with collapsible tables
- Analyze multiple datasets independently (consolidated or separate reports) or as a concatenated dataset
- Weighted Fitting with multiple weighting methods
- Confidence/prediction bands
- Fit Parameters: value, standard errors, LCL/UCL, t-value, $\text{prob}>|t|$, CI half-width
- Fit Statistics: Number of points, DOF, r value, residual sum of squares, r-square (COD), adjusted r-square, root-MSE (SD), norm of residuals, ANOVA table, covariance matrix, correlation matrix
- Residual analysis (linear, polynomial, multiple regression, nonlinear fitting)- 4 residual types (regular, standardized, studentized, studentized deleted) and 5 plot types
- Generate result using same X values as the original data, uniform linear, or uniform log X values
- Find X/Y values for new Y/X values based on fit parameters
- Copy and paste operation for fitting tools

Linear and Polynomial Fitting

- Linear fit: Fix intercept or slope
- Linear fit: Support for x-error values (PRO)
- Polynomial fit: Fix intercept
- Apparent fit
- Confidence bands, prediction bands, confidence ellipse

Multiple Dataset Linear Fitting

- Partial leverage plot in multiple regression
- Fix intercept

Nonlinear Fitting

- Nearly 200 built-in fitting functions
- Organize all fitting functions by category in an intuitive dialog, with equation and sample curve preview
- Create and edit user-defined fitting functions
- Search fitting functions (FDF) in dialog
- Define derived parameters that are computed using fit parameter values
- Global fitting with sharing of parameters
- Multiple peak fitting with auto initialization
- Automatic parameter initialization for built-in function, and support for adding initialization by value or by code, for user-defined functions

- Simulate curve or surface using desired function and parameter values
- Levenberg-Marquardt and simplex iteration algorithms
- Weighting - 13 methods including several iteratively reweighted least squares methods
- Control number of iterations, tolerance, derivative delta
- Fix parameter values, set bounds, or linear constraints
- Provide selection of parameter initialization formula for user-defined fitting functions
- Replicate (concatenated) data fitting - Fits all data, not an average, then presents result as average curve with SE or SD error bars
- Display parameter values in date/time formats.
- Fit Comparison (PRO): Compare two datasets fit with one model, or two models fit to same dataset (AIC, BIC and F-test)
- Post-fit ranking of multiple functions by category (PRO)
- Surface (XYZ or matrix) fitting (PRO)
- Rotated 2D Gaussian function for surface fitting (PRO)
- Find-Z tool for nonlinear surface/matrix fitting (PRO)
- Fitting function builder to help to define new fitting functions
- Fit multiple peaks on surface using replicas (PRO)
- Orthogonal distance regression for fitting implicit/explicit functions (PRO)
- Standard error reported for derived parameters
- Specify X data range From and To values using X values for fitted curve
- Custom X data range for fitted curve
- Use the specified row range/X range to order data during the analysis
- Ability to fit one dataset at a time when performing independent fit on multiple datasets. Ability to copy fit values from one dataset to all other datasets. Fitting with integral function in NLFit
- Improved fitting speed for LabTalk script based fitting functions

Baseline and Peak Analysis

Baseline

- Create baseline by multiple methods including straight line, user-defined anchors, existing dataset or by script

Peak Finding

- Find and mark positive and negative peaks
- Multiple methods for peak detection
- Automatically set peak area/amplitude bounds based on peak direction



Peak Integration

- Integrate peaks with fixed or arbitrary window width for each peak

Peak Fitting (PRO)

- Find and fit multiple peaks
- Multiple methods for peak finding including hidden peak finding
- Use built-in or user-defined peak fitting functions
- Assign same or different functions to different peaks
- Support for linear constraints and bounds on parameters
- Batch peak analysis using pre-defined Theme
- Sequential initialization of parameter values in batch peak analysis

Signal Processing

- Correlation
- Coherence (PRO)
- 2D correlation (PRO)
- Convolution and deconvolution
- Create upper and lower envelopes for curves (PRO)
- Decimation to reduce data (PRO)

Transforms

- FFT/IFFT
- STFT (PRO)
- Hilbert Transform (PRO)
- 2D FFT/2D IFFT (PRO)
- Image Profiling: simple line profiling: horizontal, vertical, straight line

Filtering

- FFT Filter: low pass, high pass, band pass, band block, noise threshold
- IIR filter design (PRO)
- 2D FFT Filter (PRO): support 3 types of filter windows: Ideal, Gaussian, Butterworth, Blackman, 4 filter types for each filter window: low-pass, high-pass, band-pass, band-lock, and filter defined using spectral power threshold

Smoothing

- Smoothing: Savitzky-Golay, adjacent averaging (running average), FFT filter smoothing, percentile filter (including median filter), LOESS/LOWESS

Wavelet Analysis

- Decompose (discrete wavelet transform - DWT) (PRO): 1D and 2D
- Reconstruct (inverse DWT - IDWT) (PRO): 1 and 2D
- Continuous transform (PRO)
- Wavelet smooth (PRO)
- Denoise (PRO)

Image Processing

Image Adjustment

- Color Adjustments: intensity (brightness, contrast, gamma), color (hue, invert, saturation, color balance)
- Equalizer: Histogram equalize, histogram contrast, auto level

Conversion

- Select region of interest: cut, copy, create new matrix
- Channels (PRO): RGB split, RGB merge
- Color resolution conversions: Color to gray, color to B/W (Binary, Dynamic Binary (PRO), thresholding (PRO))
- Image scale: Reset X/Y coordinates (PRO)

Geometric Transformations

- Geometric transforms: Rotate, flip (H/V), shear, auto trim, crop, resize, offset

Spatial Filters

- Spatial filters: Blur (average, Gaussian), noise (add noise, median), sharpen (sharpen, unsharp mask), edge detect, user filter (PRO)

Arithmetic Transform

- Lookup Table (PRO): function LUT, user defined
- Arithmetic Transforms (PRO): pixel logic, math function, image combine, alpha blend, background subtract, extract to XYZ, morphological filter, replace background, subtract interpolated background
- Color detect (PRO): detect, segment, replace

Mathematics

Simple Math

- Simple math between datasets: =, +, -, x, ÷
- Subtract reference data or straight line
- Normalization across single/multiple columns or curves

Interpolation/Extrapolation

- 1D Interpolation/Extrapolation - linear, cubic spline, b-spline, Akima spline
- Interpolate XY dataset to find Y values based on an existing set of X values
- 2D Interpolation - nearest, bilinear, bicubic, spline, biquadratic
- Trace interpolation
- 3D interpolation

Calculus

- Calculus: integration and differentiation including Savitzky-Golay smoothing during differentiation

Matrix Mathematics

- Matrix inverse
- Compute surface area of matrix data (PRO)

Statistics

Descriptive Statistics

- Column and row statistics (both support grouping)
- Analyze input data independently (consolidated or separate reports) or combined
- Support for grouping and weighting with row/column statistics and many other statistical analyses
- Flat sheet output for column statistics
- Moments: N total, N missing, sum, mean, mode, geometric mean, geometric SD, upper/lower CI of the mean, standard deviation (SD), SD^2 , SD^3 , standard error of mean, variance, coefficient of variation, Skewness, kurtosis, mean absolute deviation, Corrected or uncorrected sum of squares, sum of weights (statistics on columns only)
- Quantiles: minimum, index of minimum, 1st quantile (Q1), median, 3rd quantile (Q3), maximum, index of maximum, interquartile range ($IQR = Q3 - Q1$), range (maximum - minimum), custom percentile(s)
- Extreme values
- Variance divisor of moment: DF, N, WDF, WS, WVR
- Interpolation of quantiles: weighted average left, Weighted average right, nearest neighbor, empirical distribution (None), empirical distribution with average, Tukey Hinges
- Cross Tabulation (PRO)
- Distribution fit (PRO)
- Frequency count
- Discrete frequency
- 2D Binning (incl. support for periodic data)

- Normality Tests: Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors, Anderson-Darling, D'Agostino-K squared, and Chen-Shapiro
- Correlation(PRO): Pearson r, Spearman r, and Kendall Coefficients
- Partial Correlation (PRO)
- Grubbs test and Q-test to detect outliers

Parametric Hypothesis Tests

- One- and two-sample t-tests (on rows or on columns or summarized data)
- Paired sample t-test (on rows or on columns or summarized data)
- Welch corrected t-test
- One sample chi-square test for variance (PRO)
- Two sample F test for variance (PRO)
- Confidence levels for one sample chi-square variance (PRO)
- Confidence levels for two sample F variance (PRO)
- Indexed or raw data
- One- and two-proportion testing (PRO)

ANOVA

- One-way/Two-way ANOVA
- Three-way ANOVA (PRO)
- One-way/Two-way repeated measures ANOVA (PRO) (balanced or unbalanced data)
- Indexed or raw data
- Means comparison tests: Bonferroni, Scheffé, Tukey, Dunn-Sidak, Dunnett (repeated measures only), Fisher LSD, Holm-Bonferroni, Holm-Sidak
- Tests for equal variance: Levene, Levene Square, Brown Forsythe
- Power analysis

Nonparametric Hypothesis Tests

- Wilcoxon Signed Rank Test (PRO)
- Mann-Whitney Test (PRO)
- Wilcoxon Matched Pair Test (PRO)
- Kruskal-Wallis ANOVA (PRO)
- Friedman ANOVA (PRO)
- Sign Test (PRO)
- Kolmogorov-Smirnov Two-Sample Test (PRO)
- Mood's Median Test (PRO)
- Indexed or raw data



Multivariate Analysis

- Principal Component Analysis (PRO)
- Hierarchical Cluster Analysis (PRO)
- K-Means Cluster Analysis (PRO)
- Discriminant Analysis (PRO)
- Canonical Discriminant Analysis (PRO)
- Partial Least Squares Regression (PRO)

Survival Analysis

- Kaplan-Meier Analysis (PRO)
- Cox Proportional Hazards Model (PRO)
- Survival Function Comparison (PRO): Log-rank, Breslow, Tarone Ware
- Weibull Fit (PRO) :Perform Weibull fit and plot probability with confidence limits

ROC Curves

- ROC Curves (PRO)
- Support test direction, including positive vs high (larger test measurement values indicates more positive test) and positive vs. low (smaller test measurement values indicates more positive test)
- Output cut off values

Power and Sample Size

- One/Two Sample t-test (PRO)
- Paired-Sample t-test (PRO)
- One Way ANOVA (PRO)
- One/Two-Proportions test (PRO)
- One/Two Variance test (PRO)

Programming

LabTalk Scripting

Overview

- High-level, full-featured, easy-to-learn programming language
- More than 15 years of language stability and progressive development
- Access to Origin objects and operations to easily automate or customize Origin
- Detailed documentation and practical examples shipped with Origin
- Wiki site available to offer timely, updated documentation
- Large Origin user community participating in LabTalk programming forum

- Colored pairs of parentheses in function formula

LabTalk Features

- A variety of basic data types including numeric (integer, double, constant), dataset, string, string array, tree
- Variables can be strongly and dynamically typed
- Range notation for flexible data access
- Organize script by sections or files
- Define variables with different scopes: project, session, local
- LabTalk Variable Viewer to view, update, or delete variables including support for tree variables
- System variables for controlling various options in Origin
- Internal and external objects with methods and properties
- C-like programming with loops (repeat, loop, for), and decision structures
- Define macro with arguments
- Support for event-driven execution
- Easy increment of objects using ":" operator and "end" keyword
- Interactively execute scripts
- Debug script using Code Builder
- Protect multiple lines of code using "{" and "}"
- Over 60 built-in commands for data manipulation, display control, and user interface
- LabTalk command to convert C and CPP files to encrypted OCZ files for distribution
- Built-in immediately programmable GUI construction
- Built-in functions for string manipulations, dates and times processing
- Built-in functions for graph object properties
- Create user-defined function
- Add or customize menu commands
- Create buttons to execute any built-in or user-defined task
- Perform batch processing
- Easy access to Origin C functions from script
- Access to hundreds of built-in X-Functions for performing various tasks in Origin
- System Variables dialog to customize system variables and save them as default settings



Origin C

Overview

- Code builder for building and debugging Origin code created in either LabTalk or Origin C
- Using code builder to manage Origin C files in packages (OPX)
- Advanced programming language that supports ANSI C and some C++, C# features
- Easy access to Origin objects and operations to automate and customize Origin
- X-Functions framework providing a structured programming environment for building Origin tools
- Detailed documentation and practical examples shipped with Origin
- Wiki site available to offer timely, updated documentation
- Large Origin user community participating in Origin C programming forum

Origin C Features

- Origin C supports a nearly complete ANSI C language syntax
- Encrypt Origin C files (OCZ)
- Supports a subset of C++ features including mid-stream variable declarations, overloaded functions, built-in and user-defined classes, references to variables and default function arguments
- Supports a subset of C# features including collections of objects, *foreach* and *using* statements
- Support for HTML control and call JavaScript to build dialogs
- Built-in C++ classes for programmatic access to most Origin objects
- Built-in immediately programmable user interface development
- Immediate vector, matrix, tree structures programming
- Immediate access to all routines in the 64 bit NAG® Mark 26.1 function libraries for a wide range of mathematical and statistical functions
- Built-in global functions organized in 25+ categories
- Create complex user-defined curve fitting functions for use in Origin's advanced curve fitting tool
- Support error and exception handling using Throw, Try, and Catch statements
- Support for database access
- Easy integration with LabTalk scripts

- Hundreds of built-in X-Functions can be easily accessed and extended
- Create user-defined X-Functions
- Call external DLLs created with other languages such as C, C++ and Fortran

Origin as Automation (COM) Server

- Access Origin as an automation server from client applications such as Microsoft® Excel®, National Instruments™ LabVIEW™, or any COM-capable client application
- Run Origin visible or hidden
- Send data and commands to Origin for graphing and analysis tasks. Fetch results back to client application
- Utilize Origin's Analysis Template capability to automate routine tasks
- Large collection of classes to access various Origin objects and properties
- Run LabTalk script or Origin C code

Integrated Python Environment

- Run Python commands in the Script Window
- Execute Python files with LabTalk commands
- Python 2.x and 3.x support
- PyOrigin module to access Origin objects from Python
- Python Package OriginExt to Access Origin Functionality from External Python through COM.
- Running R in Origin
- R Console and Rserve Console to run R commands within Origin or exchange data between Origin and R
- Run R commands or execute R files with LabTalk commands

