



C R E A S O

T E C H N I C A L I N F O R M A T I O N

I D L 7 . 1

OPERATING SYSTEMS

- Windows XP SP2, Vista (32-bit & 64-bit)
- Linux kernel 2.6.9, glibc 2.3.4, gtk2 2.4.13 (32-bit & 64-bit)
- MacOS X 10.5.1 PowerPC (32-bit), Intel (32-bit & 64-bit)
- Sun Solaris 10 SPARC (32-bit & 64-bit), x86 (64-bit, command line mode only)

DATA FORMATS

- Data structures: Scalar, Vector, Array, Aggregate structures
- Data types: byte, 16-, 32-, 64-bit signed/unsigned integer, string, single & double-precision floating point, single & double precision complex
- Pointers: Circular, self-referential data structures
- IEEE support: Infinity, Missing data (IEEE NaN)
- Save/Restore facility (binary format)
- Direct access unformatted binary I/O
- Formatted I/O (default or user-specified)
- Scientific data formats: CDF 3.2, HDF 4.2r3, HDF 5 5-1.6.7, HDF-EOS 2.8, netCDF 3.6.2
- ASCII CSV
- BMP (Microsoft Windows Bitmap)
- DICOM version 3 part 10 support
- DXF (AutoCAD)
- ESRI ArcView Shapefiles
- GeoTIFF
- GIF (Graphics Interchange Format)
- JPEG, JPEG2000 (Joint Photographic Experts Group)
- Motion JPEG2000
- MPEG (Moving Picture Expert Group)
- MrSID (Multiresolution Seamless Image Database)
- PICT (Macintosh bitmap)
- PNG (Portable Network Graphics)
- SRF (Sun Raster Files)
- SYLK (Symbolic Link)
- TIFF, ITIFF (single or multi-channel)

- VRML (Virtual Reality Modeling Language)
- WAV Audio files
- WMF (Windows MetaFile)
- XDR (eXternal Data Representation)
- XML (Extensible Markup Language)
- XWD (X Windows Dump)
- Zip file compression/decompression

REMOTE ACCESS

- Socket support (client-side TCP/IP)
- HTTP and FTP server access
- Non-secure OGC WMS and OGC WCS server access

MULTI-THREADED COMPUTATIONS

- Binary & unary operations
- Mathematical routines
- Image processing routines
- Array creation routines
- Array manipulation routines
- Out-of-process server (IDL_IDL Bridge)

2-D PLOTTING & GRAPHICS

- iTools for interactive image analysis, contouring & plotting
- OpenGL accelerated image rendering
- 2-D transformations
- Opacity and layering control
- Animation
- Image tiling
- RGB, HLS, HSV, indexed color display
- Zoom & pan
- Image annotation
- Interactive contrast enhancement
- Double precision plotting with date/time support
- Contour plots, automatic boundary close, unlimited contour levels, filled contours



C R E A S O

- Line plots, scatter plots, histograms, bars graphs, polar plots, error bars, dendrograms
- Linestyle, patterns, plot symbols
- Log, semi-log & linear scaling
- Overplot multiple data sets
- Vector flow diagrams

SURFACE PLOTTING & 3-D GRAPHICS

- iTools for interactive 3-D graphics, surfaces & volumes
- OpenGL accelerated 3-D graphics
- 3-D transformations
- 4-D data display of gridded or non-gridded elevations with overlaid image or user-specified shading
- Interactive DXF (AutoCAD) viewer
- Interactive light object editor
- Isosurface & isocontour
- Mesh generation (tetrahedral mesh from volumetric data)
- Mesh surface plots with hidden line removal
- Mesh operations (polygonal & tetrahedral meshes): Clipping, Decimation, Smoothing, Surface area & volume, Validation
- Particle trace & streamline
- Volume rendering
- 3-D plot symbols & text
- Flat & Gouraud shading
- Lighting model effects
- Opacity controls
- Texture Mapping (high resolution)
- Multiple clipping planes

GRAPHICS ARCHITECTURE

- OpenGL accelerated 3-D graphics
- OpenGL Shading Language
- Highly efficient rendering
- Real-time interactivity
- Multibyte text character support in iTools & object graphics
- Support for multiple monitors
- Z-buffered graphics (8-bits, 24-bits)

COLOR SYSTEMS

- Convert to/from: CMYK, HSV, HLS, YUV, YIQ, YPbPr, YCbCr
- Convert true-color to pseudo-color
- Color mapping functions

PRINTING & FONTS

- High-quality, scalable TrueType® fonts
- Hershey fonts
- Native print dialogs - page set-up, print job
- Printing directly to a printer device
- Vector and bitmap printing & clipboard
- Printer support: PostScript, PCL, HPGL2, HP-RTL
- PostScript preview

- User-extensible font set
- WYSIWYG printing

CURVE & SURFACE FITTING

- Multiple linear regression
- Nonlinear least-squares: Gradient-expansion, Levenberg-Marquardt, Singular value decomposition
- Polynomial spatial warping
- Polynomial surface
- Weighted & unweighted least-squares polynomial
- Thin plate spline

IMAGE & SIGNAL PROCESSING

- iTools for interactive image display and processing
- Adaptive Fast Fourier transform: Mixed Radix, 1 to 8 dimensions, Multi-threaded
- Bi-level, pseudo- & true-color thresholding
- Butterworth filter
- Canny filter
- Convolution & frequency-domain block convolution
- Edge Enhancement: Roberts, Sobel
- Edge detection filters: Difference of Gaussians, Emboss, Laplacian, Prewitt, Shift difference
- Unsharp masking
- Frequency domain filtering & analysis
- Generalized image arithmetic
- Geometric transformations: magnification, reduction, rotation, polynomial warping
- Hough transform
- High- & low-pass filtering
- Histogram equalization & processing
- Adaptive histogram equalization
- Image statistics
- Impulse Response filter
- Lomb periodogram
- Median filtering
- Morphological operators: erode, dilate, distance mapping & thinning
- Noise functions: hurl, pick, scatter, slur
- Noise reduction & image restoration filters: BAND_PASS, BAND_REJECT, LEAST_SQUARES, MEAN, ORDER_STATISTIC, WIENER
- Radon transform
- Region growing
- Region of interest (ROI) utility
- Savitsky-Golay filter
- Spectral analysis
- Time-series analysis
- Watershed segmentation
- Continuous & discrete wavelet transforms



WAVELET TOOLKIT

- Interactive interface
- Multiresolution analysis

DIFFERENTIATION & INTEGRATION

- Differential equations: adaptive & Runge-Kutta
- Iterated Gaussian quadrature
- Newton-Cotes integration of tabulated data
- Romberg integration over an open or closed interval
- Simpson integration over a closed interval

LINEAR ALGEBRA

- LAPACK & Numerical Recipes routines
- Condition number
- Determinant
- Generalized inverse
- Transpose
- Infinity & Euclidean norms
- Eigenvectors & eigenvalues
- Singular value decomposition
- Cholesky, Gauss-Seidel, LU, Cramer's, least squares & tridiagonal methods for solving systems of linear equations

SPARSE LINEAR SYSTEMS

- Dense-to-sparse & sparse-to-dense conversions with thresholds
- Iterative biconjugate-gradient algorithm for solving linear equations
- Multi-dimensional optimization
- Row-indexed sparse storage format
- Sparse format file I/O
- Sparse matrix-matrix & matrix-vector multiply

NONLINEAR SYSTEMS & ROOT FINDING

- Broyden's & Newton's globally-convergent algorithms
- Laguerre's algorithm for polynomial root-finding
- Muller's algorithm for real & complex root-finding

MULTI-DIMENSIONAL OPTIMIZATION

- Davidon-Fletcher-Powell minimization
- Gradient-free Powell minimization
- Simplex method

SPECIAL & TRANSCENDENTAL FUNCTIONS

- Beta & incomplete beta functions
- Error & exponential integral functions
- Exponentials & logarithms
- Forward & inverse Chebyshev polynomial expansion
- Gamma, incomplete gamma & logarithmic gamma functions
- I-Bessel, J-Bessel, K-Bessel & Y-Bessel functions

- LaGuerre and Legendre polynomials
- Spherical Harmonics
- Trigonometric, inverse trigonometric & hyperbolic functions

CORRELATION ANALYSIS & FORECASTING

- Auto & cross covariances/correlation
- Autoregressive modeling/forecasting
- Cluster analysis
- Differencing/box-car smoothing
- Discrete auto/cross correlation
- Exponential, geometric, Gompertz, hyperbolic, logistic & logsquare growth models
- Kendall & Spearman rank correlations
- Lagged auto & cross correlations
- Least-absolute-deviation fitting
- Linear, multiple & partial correlations
- Moving averages/smoothing
- Multiple linear regression
- Multiple correlation
- Nonlinear least-squares fitting
- Partial correlation
- Principal components
- Statistical fitting of data

HYPOTHESIS TESTING

- Chi-square test
- Contingency test for independence
- Cumulative binomial (Bernoulli)
- F test
- Gaussian (normal)
- Kruskal-Wallis H-test
- Lomb frequency test
- Mann-Whitney U-test
- Median delta test
- Normality test
- Random numbers: Normal & uniform, single & double precision
- Runs test for randomness
- Sign test
- Student's T tests
- Wilcoxon rank-sum test

MULTI-DIMENSIONAL GRIDDING & INTERPOLATION

- 1-, 2- & 3-D nearest-neighbor & linear
- 1-, 2- & 3-D cubic convolution
- 2-D parametric cubic splines
- N-D Delaunay triangulation, convex hulls & Voronoi polygons
- 2-D interpolation: Inverse distance, Faulting, Kriging, Linear, Minimum curvature, Modified Shepard's, Natural neighbor, Nearest neighbor, Polynomial regression, Quintic, Radial basis function



C R E A S O

- 3-D minimum curvature surfaces
- 3-D polar (r, theta, z) to rectangle
- 4-D smooth fit
- Non-uniform gridding
- Spherical gridding

MAPPING

- iTools for interactive exploration of georeferenced image and contour data
- High-resolution map database
- 30+ geographic mapping transformations (includes USGS GCTP)
- Warp images onto arbitrary projections

DEVELOPMENT & PROGRAMMING TOOLS

- Support for large files (>2GB)
- Programming language features similar to C
- Macintosh AltiVec acceleration
- Callable Unix sharable object library & Windows DLL
- Out-of-process server (IDL_IDL Bridge)
- Extensible: add FORTRAN or C code with child processes or dynamic linking
- Export IDL objects into COM/Java
- Import COM/Java objects into IDL
- Immediate execution of interactive statements
- Operators, procedures & functions operate directly & efficiently on scalars, vectors & arrays
- Object oriented programming interface
- System constants
- File manipulation routines
- Unlimited compiled program size
- Unlimited number of variables
- Unlimited program file names
- Unlimited structure tags
- Distribution options, including free IDL Virtual Machine

INTEGRATED DEVELOPMENT ENVIRONMENT - IDL WORKBENCH

- Cross-platform native user interface (UI)
- Edit, run debug IDL code
- Keyboard accelerators
- Syntax highlighting of IDL code
- Drag-and-drop editing
- Hover Help display from the mouse cursor position
- Content Assist helps complete a routine
- Display of matching parentheses and brackets
- Debug view displays the IDL call stack in graphical format

- Profiler view shows execution time
- Projects organize source code and files
- File menu to open & read files into Variables view
- Drag & drop variables to Tool Palette to render visualizations
- IDL session command line access
- RSS feeds for news and update information
- Internationalized and localized UI supports several Asian and European languages
- Plug-in updated and extensions to IDL
- Build cross-platform IDL applications

USER INTERFACE TOOLKIT

- Cross-platform tools for creating graphical user interfaces (GUI) with native look & feel
- Animation tool
- Annotation tool
- Interactive file selector
- Interactive color palette editor
- Tab key navigation and button accelerators
- Widgets/Controls: Base, Button (push & toggle), Context sensitive shortcut menu, Drawable (expose, click, drag & wheel events), Droplist/Combobox, Label, List, Message, Property Sheet, Slider, Tab, Table, Text, Tree (with drag and drop)

IDL DATAMINER™ MODULE

- Same API for all platforms & databases
- Create, delete, query tables
- Execute arbitrary SQL statements
- Get/set/query/add/delete records
- Drivers for: Oracle, Informix, Sybase, MS SQL Servers, MySQL

DICOM READ/WRITE MODULE

- Read, clone & create DICOM part 10 files
- Public & private attributes including sequences & groups
- JPEG compression (Windows & UNIX)
- Windows, SPARC Solaris, Mac OS X (PPC only) & Linux

DICOM NETWORK SERVICES

- Query/Retrieve SCU
- Storage SCU, SCP
- Echo SCU, SCP
- Includes all functionality of the DICOM R/W Module
- Windows, SPARC Solaris, Mac OS X (PPC only) & Linux

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