

nCode GlyphWorks® 8



Product Details

Product Overview:

nCode GlyphWorks is a powerful data processing system for engineering test data analysis with specific application to durability and fatigue analysis. Designed to handle huge amounts of data, GlyphWorks provides a graphical, process-oriented environment. Users can simply create an analysis workflow by 'dragging and dropping' analysis building blocks.

In addition to general signal processing, GlyphWorks provides leading fatigue analysis capabilities for measured data. Unique capabilities include the ability to help specify accelerated durability tests, saving both time and money in environmental qualification and product validation.

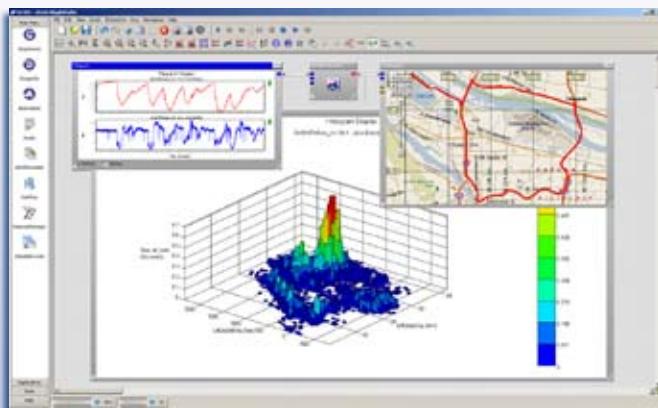
nCode GlyphWorks can also be accessed through nCode Complete Durability System (nCode CDS), a licensing system providing flexible use of all nCode desktop products.

Key Benefits:

- **Comprehensive analysis** for experts but simple to use for occasional users, raising team effectiveness
- **Save time and cost** with faster, more realistic durability tests
- **Improved correlation** using test and CAE in one environment
- **Improved consistency and quality** with standardized analysis processes
- **'One-click' generation of results and reports.** Go straight from raw data to finished document and improve productivity

Key Features:

- **Durability and fatigue analysis:** Specialized capabilities for damage calculation and test profile generation
- Integrates with nCode DesignLife to enable test and CAE fatigue in **one environment**
- **Graphically** develop analytical processes: Intuitive and powerful
- **Intrinsically multi-file, multi-channel and multi-format:** Optimized for complex analysis and huge file sizes
- **Wide range of functions** for time, frequency, and statistical analysis, plus synchronized GPS and video displays
- **Flexible:** Build custom functions using MATLAB® or Python programming language and IMSL® numerical libraries, or link to existing processes



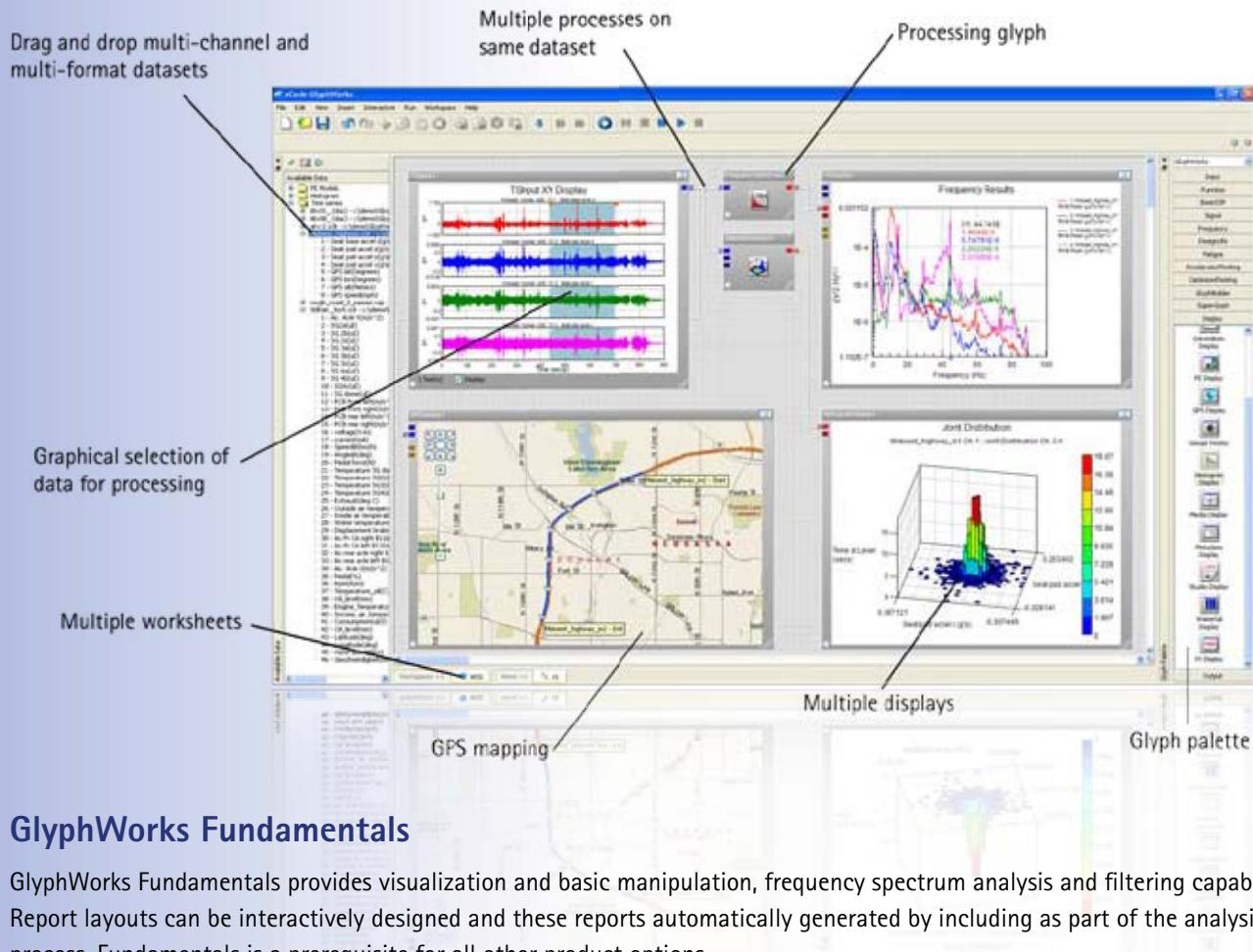
nCode **GlyphWorks®** G

Data Processing System
for Durability



Core Functionality for Durability Analysis

nCode GlyphWorks provides a wide range of data processing capabilities with specialized options such as fatigue analysis, accelerated testing, and frequency domain tools for ride quality and rotating machinery analysis.



GlyphWorks Fundamentals

GlyphWorks Fundamentals provides visualization and basic manipulation, frequency spectrum analysis and filtering capability. Report layouts can be interactively designed and these reports automatically generated by including as part of the analysis process. Fundamentals is a prerequisite for all other product options.

The Fundamentals package includes support for a wide range of data formats and types of displays. The **Super glyph** capability enables multiple analysis functions to be encapsulated as a single glyph that can be saved and re-used.

GlyphWorks Fundamentals includes:

- Input multiple formats
- Channel calculator
- Channel reassignment
- Filtering
- Extraction and concatenation
- Statistics and running statistics
- Resampling
- Unit conversion
- Frequency analysis
- Time at level analysis
- Rainflow counting
- Graphical editor
- Visualization and reporting
- Output multiple formats
- Batch and interactive interfaces
- Super glyph encapsulation
- ScheduleCreate durability duty cycle definition

Product Options

Fatigue

GlyphWorks provides the industry-leading fatigue analysis technology you need to calculate fatigue life from measured data. You can correct for mean stress and surface finish effects, even back calculate from each data channel to determine a scale or fatigue concentration factor required to achieve a target life. You can then review damage histograms to determine which load cycles were most damaging, and even output damage time histories to show exactly when the damage occurred. A database with commonly used fatigue data is also provided.

- **Stress-Life** method uses a nominal stress approach for high-cycle conditions or non-metallic applications. A wide range of methods is provided for defining the SN curves including the ability to interpolate multiple material data curves for mean stress effects. For ultimate flexibility, Python scripting enables the definition of custom fatigue methods and material models.
- **Strain-Life** method is more appropriate for more severe loading conditions (low-cycle fatigue) – where local elastic-plastic strain controls the fatigue life. Supported methods include the Coffin-Manson-Basquin formula with additional mean stress corrections such as Morrow and Smith-Watson-Topper.
- **Crack Growth** provides linear elastic fracture mechanics to determine how a crack will propagate after initiation. Complete fracture mechanics is performed using industry standard methodologies, an open environment for users to embed their own algorithms – and advanced reporting and quality assurance capabilities. Built-in growth laws include NASGRO3, Forman, Paris, Walker, and more.
- **Creep Analysis** performs creep calculation for time in hours to rupture – typically occurring at temperatures above 30% of the melting point (in Kelvin). Supported methods include Larson-Miller which uses a creep curve that is either paired points X-Y curve or polynomial function and Chaboche method using a family of curves, each for a specific temperature.

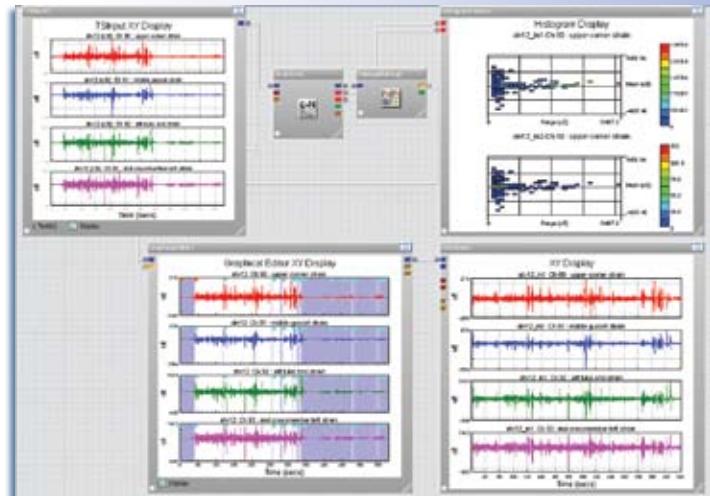
Fatigue Editing

Driving a time domain simulation rig such as a vehicle 4-post rig typically requires large amounts of measured data. Fatigue Editing is an option used to perform damage sensitive editing to generate shorter time series data that retain the required damage.

With Fatigue Editing you can:

- Shorten multi-axial durability tests while retaining damage to save time and money
- Assess the trade-off between time saved and damage retained across multiple channels

A highly flexible tool, Fatigue Editing uses the powerful Fatigue glyphs, enabling the user complete control over the parameters used in the damage calculations.



Processes can be locked down, capturing corporate knowledge and improving consistency

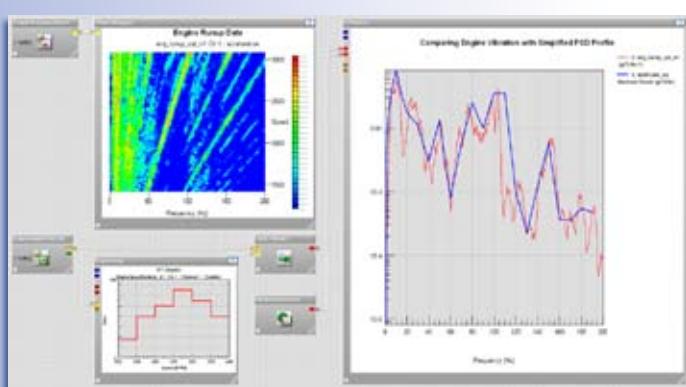
Product Options

Accelerated Testing

Vibration qualification for environmental testing can be a time-consuming process. GlyphWorks Accelerated Testing provides the ability to create a representative PSD or swept sine shaker vibration test based on measured data. It enables the combination of multiple time or frequency domain data sets into representative test spectra that accelerate the test without exceeding realistic levels.

With Accelerated Testing you can:

- Quantify and compare the vibration levels and fatigue damage for given vibration shaker tests
- Accelerate a vibration test using objective, justifiable and quantitative methods
- Qualify a component in a new vibration environment using read-across evidence from a qualification in another vibration environment



Save time and money with more efficient durability tests

GlyphWorks **Accelerated Testing** is the only known supported commercial software that makes it possible to quantify the fatigue damage of a vibration test. It is based on GAM EG-13/NATO AECTP200 standards and allows users to design test scenarios that take a fraction of the time of a traditional test.

Accelerated Testing also enables measured test data to be compared with the severity of the testing profile, thus enabling assessment of whether components in service will likely survive to the target service life. This known safety margin may help extend the life of parts in service or conversely avoid unexpected failures.

Optimized Testing

Physical durability testing often requires determination of the optimum, most efficient mix of events required to match an overall target. In automotive applications for example, the challenge is to obtain the best value from proving ground usage. Optimized Testing provides a proven approach to find the optimum solution across many channel locations.

A wide range of inputs from measured data such as rainflow cycle counts or relative damage values enables many industry applications. The optimization methods for best fit least-squares regression and constrained minimization routines employ robust algorithms from IMSL® Numerical Library.

With Optimized Testing you can:

- Significantly reduce proving ground track usage
- Optimize testing schedules and reduce testing time
- Understand how real world usage compares to track data
- Rapidly compare different proving grounds or duty cycles

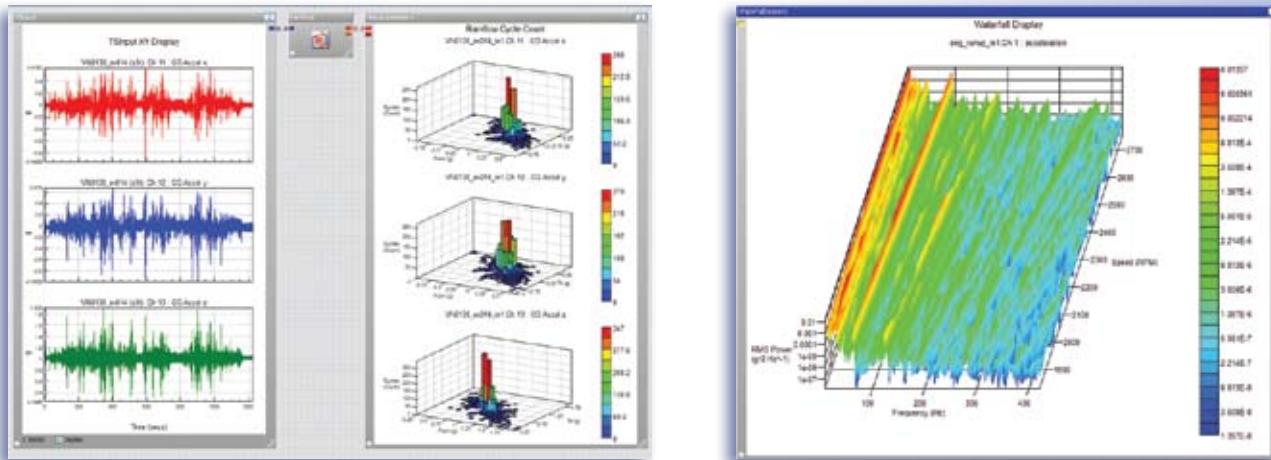
Product Options

Signal

The Signal option delivers additional signal analysis capability and is particularly well-suited to durability test applications. It also provides a set of glyphs to detect 'features' within time series data. These glyphs are powerful tools used to find problems within data such as spikes, drift, and flat-lines. These features within the data can then be viewed and corrected automatically using other glyphs such as the Graphical Editing glyph.

Signal option includes:

- Level crossing counting
- Joint distribution analysis
- Peak valley slice
- Markov counting
- Relative damage calculation
- Flat-line detection
- Spike detection
- Drift detection
- Frequency-banded relative damage spectrum
- Rainflow extrapolation



Frequency

The Frequency option provides a powerful, simple-to-use range of noise and vibration analysis capability with particular application to rotating machinery, octave analysis and frequency response. Specific functionality is also provided to assess vehicle ride quality analysis to ISO 2631 Whole Body Vibration standard and hand-arm vibration assessment to ISO 5349 standard.

Frequency option includes:

- Frequency response for gain, phase and coherence of linear systems
- Joint time frequency
- Octave analysis in accordance with ANSI S1.11-2004
- Spectrum weighting
- Order tracking filter
- Waterfall analysis for rotating machinery
- Waterfall display including cursor slicing
- Custom Fourier filter for user defined filter definition
- Weighting filters including A, B, C noise filters and human body vibration in accordance with ISO 2631, ISO 5349

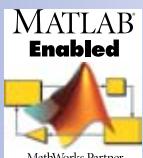
Product Options

IMSL Statistics

IMSL Statistics includes a **Curve Fitting glyph** for linear regression, polynomial regression up to 9th order and spline fitting. This glyph uses statistical routines of the IMSL C Numerical Library. These mathematics and statistics functions can also be accessed using Python programming in the Scripting glyph (see GlyphBuilder option) using the special Python-enabled PyIMSL™, which is also distributed with GlyphWorks.

GlyphBuilder

The GlyphBuilder option combines the capabilities of the **Scripting** and **Open glyphs** to add even more functionality to GlyphWorks. Users can add their own unique or proprietary methods and file formats to GlyphWorks using these glyphs.



The **Scripting glyph** extends functionality in GlyphWorks by enabling users to write their own glyphs using MATLAB or Python programming language.

Open glyph gives direct access to external applications from within a GlyphWorks process. The Open glyph executes a given command line operation and in this way external code or scripts such as Visual Basic®, Java™, nCL, C++, etc., can all be called using data from the process.

ASAM ODS

Gain access to search and select data from your ASAM ODS database within GlyphWorks!

The interface to the ASAM ODS data enables interactive browsing, editing of metadata, and searching based on metadata, all within GlyphWorks. ASAM ATF and XATF files are also supported and can be both imported and exported.

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GPS Display

GPS Display glyph plots latitude and longitude GPS data on a map or grid background. Data can be exported to a Google KML file to enable easy viewing in Google Maps™ or Google Earth™. Feature lists are also supported, allowing locations of interest on the data lines to be automatically identified and marked. Regions for editing data can be defined based on geographical location.

Embedded mapping capability in the GPS Display glyph requires Microsoft® MapPoint® 2006 or 2009 to be installed.

Media Display

Media Display glyph enables video and audio signals to be played using Windows Media® Player embedded in the glyph. It also enables cursor synchronization with other data displays to gain insight on what was occurring in other signals. The **Gauge Display glyph** enables synchronized values to be displayed during playback in a variety of styles such as angular gauges or digital read-outs.

nCode Automation Personal Edition

nCode Automation Personal Edition (PE) is fully integrated with and is an ideal addition to GlyphWorks. It enables you to search, organize and analyze data that is stored on your computer and helps you to rapidly gain more value from your data analyzed in GlyphWorks.

For more details, see the nCode Automation product details sheet.

nCode GlyphWorks Technical Features

Data Import

Time Series

- ASAM ATF/XATF
- ASCII (via ASCIITranslate)
- B&K Pulse .pti
- DEWEsoft .d7d
- DSPCon DATX
- EDASWin EDT
- ETAS MDF3
- HBM catman .bin, MEA format
- I-DEAS Pro ATI
- imc FAMOS RAW
- KAMTranslate for Acra Control KAM-500 hardware
- Kyowa KS2
- LDS Nicolet .pnrf
- Lexade SIG
- MATLAB
- Microsoft WAV
- MTS RPC3
- nCode s3t and DAC
- NI DIAdem DAT, TDM/TDMS
- nVision Signal
- OROS OXF
- Prosig DATS
- Saginomiya RFC
- Schenck-Pegasus SPG
- SoMat SIF, SIE, 2100 DAT
- Sony PC Scan II, III, IV and XMX
- TEAC TAFFmat
- UFF (Universal File Type 58)
- Vector MDF

Histograms

- nCode s3h, XML and DAC
- SoMat SIF, SIE, 2100 DAT
- LMS XML

Multi-column

- CSV with header
- ASCII (via ASCIITranslate)
- IPETRONIK TESTdrive CAN
- Microsoft Excel .xls and .xlsx
- nCode s3m

Data Generation

- Square wave, Sine wave
- Swept sine
- White noise
- Triangular wave
- Schedule and block cycle definition
- Sine on random

Data Export

Time Series

- ASAM ATF/XATF
- ASCII
- EDASWin EDT
- HBM catman .bin
- MATLAB
- Microsoft WAV
- MTS RPC3
- nCode s3t and DAC
- NI DIAdem DAT, TDM/TDMS
- nVision Signal
- Saginomiya RFC
- SoMat SIF

Histogram

- nCode s3h and XML

Multi-column

- nCode s3m
- ASCII (comma, tab or space separated)

Analysis

Data Manipulation

- Channel concatenation
- Channel number reassignment
- Section extraction
- Delete sections
- Scale/offset section
- Ramp or Half sine wave sections
- Sample rate adjustment
- Units conversion
- Append channels to tests
- Extract channels from tests
- Turning point extraction – single or across multi channels

- Convert Time to Distance or Angle domain
- Find simultaneous values across multiple channels at maximums and minimums
- Turn a pulse signal into a smooth speed signal
- Create/calculate new metadata items
- Automated sorting and filtering of tables

Data Classification

- Amplitude distribution – Probability density, point count, time at level
- Frequency spectrum – PSD, Amplitude and Energy spectrums
- Joint probability distribution function
- Level crossing
- Rainflow cycle counting – Range Mean, From To, Max Min, Range Only
- Markov counting – from-to transition histogram binning

Calculus

- Differentiation
- Integration
- Automated unit conversion

Arithmetic Functions

- Extensive mathematical operations on data
- Add, Subtract, Multiply, Divide, Powers of, Square root, Sine, Cosine, Tangent, Secant, Cosecant, Cotangent, Equivalent anti trigonometric, Equivalent, Hyperbolic, Absolute, Log Base E, Log Base 10, Anti Log Base E, Anti Log Base 10

Frequency Analysis

- Auto spectrum of input
- Auto spectrum of response
- Cross Spectrum
- Gain
- Coherence
- Short Time Fourier, Gabor
- Full, 1/3, 1/6, 1/12, 1/24 Octave bands
- Octave analysis with ISO2631 / ISO5349 vibration weighting

nCode GlyphWorks Technical Features

- dB spectrum weighting
- Noise spectrum weighting – dB(A), dB(B), dB(C)
- User defined spectrum weighting
- Waterfall analysis
- Order slice
- Waterfall X-slice, Y-slice, Sum to 2D

Signal Filtering

- Butterworth – low, high, band pass and band stop. Up to 8th order, Forwards or Forwards/Backwards
- Fourier – low, high, band pass and band stop
- Order tracking filter
- ISO2631/UIC 513 – Wk, Wd, Wf, Wc, We, Wj, Wb
- ISO 5349 Wh
- A,B,C noise weighting
- Application of user-specified transfer function as filter

Anomaly Detection

- Spike detection – Differential, Statistical, Amplitude, Amplitude and Differentiation, Crest Factor methods
- Limit, flat line, drift detection
- Channel statistic comparisons

Statistics

Available over full signal or on a running window

- Min, Max, Mean, Range, RMS
- Standard deviation, variance, skewness, kurtosis, crest factor
- Mode, median, percentiles
- IMSL Statistics option for extended capability including polynomial regression analysis and curve fitting
- Periodic calculations for rotating machinery

Fatigue Analysis

- Stress-life (S-N) curve life and damage prediction – user defined methods using Python scripting language

- Strain-life (E-N) curve life and damage prediction – including Gray Iron materials
- Kf back calculation
- Scale factor back calculation
- Time history output for damage
- Complete schedules of multiple events
- Mean stress corrections – FKM, Gerber, Goodman, Interpolation, Smith-Watson-Topper and Morrow methods
- Surface treatment corrections
- Surface finish corrections
- Large pre-defined material database
- Relative Damage comparison
- Potential Damage Intensity comparison

Crack Growth

- Linear elastic fracture mechanics with editable architecture to enable custom models to be built

Creep Analysis

- Creep damage calculation for high temperature applications using Larson-Miller or Chaboche methods.

Optimized Testing

- Find the best mix of histogram or multi-column data to match an overall target
- Log and linear optimization using best fit least squares regression
- Log and linear optimization using constrained minimization

Accelerated Testing

- Definition of spectra for PSD, swept sine, sine dwell and sine on random
- Fatigue damage spectra (Time series and PSD inputs)
- Shock response spectra (Time series and PSD inputs)
- Calculate representative PSD or swept sine signals from FDS

Fatigue Editing

- Time correlated removal of non-damaging cycles

Strain Rosette Calculations

- For both strain and stress
- Max/min, Abs Max principal
- Max shear
- Von Mises
- Strain/stress at angle
- Biaxiality ratio
- Angle

Displays

- Chart display, tabular charts
- XY data plotting
- 3D dynamic histograms
- GPS mapping (optionally using Microsoft MapPoint) – direct export to Google KML file for use in Google Earth
- Waterfall plots
- Video and audio playback and synchronization
- Gauge display

Reporting

- Report template creation to use in nCode Automation
- Output to Microsoft Word, PowerPoint®, HTML, Adobe® PDF and image formats jpg, bmp, png
- Displays and workspace have copy to clipboard function

Customization

- GlyphBuilder capability enables direct use of MATLAB or Python programming language to create new functions
- Call any command line executable process/script such as Visual Basic, Visual Basic Script, Java, nCL, MathCAD, Fortran, C++

Platform Support

- 32-bit: Windows XP®, Windows Vista®, and Windows® 7
- 64-bit: Windows XP, Windows Vista, and Windows 7, Red Hat® Enterprise 5 Linux®, SUSE® Linux® 10.2