■ NATIONAL INSTRUMENTS ■

NI DIAdem™

Technical Data Version 2011

The following table gives you an overview of the functions in the various DIAdem packages. If you are reading the document at your computer, click a function group in the first column to open the description on the following pages.

	DIAdem Base Edition [1]	*DIAdem Advanced Edition*	*DIAdem Professional Edition*	*DIAdem Crash Analysis Toolkit* [2]	*DataFinder Server Edition*
Data Management and Data Mining	✔	✔	✔		
Advanced Data Management		✔	✔		
Data Mining for Work Groups					✔
Graphical Interactive Data Evaluation	✔	✔	✔		
Videos and Measurement Data		✔	✔		
3D Display Contour		✔	✔		
Embedding User Dialog Boxes		✔	✔		
Maps and Measurement Data			✔		
3D Measurement Data Projection[3]			✔		
Report Generation	✔	✔	✔		
Create Master Layouts	✔	✔	✔		
3D Graphics		✔	✔		
Mathematical Data Analysis	✔	✔	✔		
Calculator	✔	✔	✔		
Basic Mathematics, *Channel Functions*	✔	✔	✔		
Statistics, *Regression*	✔	✔	✔		
Units Catalog		✔	✔		
Calculation Manager		✔	✔		
Process Capability		✔	✔		
Approximation, *Splines*		✔	✔		
FFT, *Digital Filters*, *Shock Response Spectrum*		✔	✔		
3D Mathematics		✔	✔		
Circle Regression, *Curve Fitting*, *LS Linear Fitting*			✔		
Frequency-Weighted Acceleration, *Order Analysis*			✔		
Extended Classification, *Rainflow Analysis*			✔		
Crash Analysis				✔	
Scripting		✔	✔		
Creating User Dialog Boxes		✔	✔		
Bar Manager and User Commands		✔	✔		

1) The DIAdem Base Edition enables the user to display layouts and to execute scripts and calculation templates that were created with DIAdem Advanced, the Professional Edition, and the Crash Analysis Toolkit,.
2) The DIAdem Crash Analysis Toolkit requires the DIAdem Base, Advanced or Professional Edition.
3) You can display the 3D measurement data projection with the DIAdem Base Edition. You need the DIAdem Professional Edition to create and manipulate the model with a script.

Data Management and Data Mining

Finding and browsing files with the DataFinder; navigating file systems and databases in DIAdem NAVIGATOR.

Mining Data with the DataFinder

- Quick search by entering a search term
- Advanced search by entering several search criteria
  - Wildcards (*,?)
  - Structured search for files, channel groups, and channels using selected properties
  - Connecting several search conditions with AND and OR
  - Suggestion list in the advanced search for selecting values for base properties and for optimized custom properties
  - Sorted loading of the search results
  - Displaying the files, channel groups, or channels found
  - Easy entry of search conditions by dragging and dropping properties from the Data Portal or the file browser
- Suggestion list with previous queries
- Saving and loading queries including the column configuration of the result list
- Optimizing custom properties to accelerate queries
- Defining search areas
  - Automatically refreshing the index
  - Manually starting the indexing of files and folders
- Accessing DataFinder Server to index data for work groups (refer to *Data Mining for Work Groups*)
- Configuring the search result list with file properties, channel group properties, and channel properties
- Transferring DataFinder configurations to other DIAdem computers

Navigating file systems and databases

- Browsing file systems down to channel level
- Dragging and dropping data sets, channel groups, and channels into the Data Portal. Loading mass data when editing.
- Registering instead of loading large data files and channels to reduce memory load and processing time
- Reduced channel loading
  - Mean, minimum, maximum, or first value, for each interval
- Displaying properties of external data in the properties display
- Channel preview: Curve display of the selected channel

Supported file formats

- DIAdem files (TDM format, TDMS format)
  - Hierarchical organization of the data in data sets, channel groups, and channels
  - Extensive documentation of the data model
  - Standard data format of NI LabVIEW and LabWindows/CVI
- DIAdem 8 files (DAT format)
- Import and DataPlugin wizard for ASCII and Excel files
- Binary files import
- LabVIEW text files (LVM format)
- ATF files and ATFX files (ASAM Transport Format)
- Importing and browsing all file formats for which a DataPlugin exists

DataPlugins

- DataPlugins are scripts for importing and searching data in ASCII format and binary format, and also spreadsheet calculation (`.XLSX`)
- Various character encodings for text files (automatic, ASCII, Unicode, Shift-JIS)
- Many DataPlugins can be downloaded free of charge from `ni.com/dataplugins`
- Easy DataPlugin exchange as self-registering URI file
- Encrypting DataPlugin scripts to protect know-how
- User-defined file symbols for display in DIAdem file browser
- Note: *To create DataPlugins you need at least the DIAdem Advanced Edition with Scripting.*

Supported databases

- ASAM ODS databases
  - Interface with data browser, search input area, search results list, and properties display
  - Variable browse settings
- LabVIEW DSC databases
- VI Logger databases
- Lookout databases
- SQL table reader for accessing databases such as Access and Oracle via ADO

Scripting capabilities

- Data navigator controls with methods and properties
- Navigator object for opening external data stores including ASAM-ODS, mining data, and selecting and loading data
- Data object for editing, deleting, or recreating data loaded in the Data Portal.
- CANtoTDM object for importing CAN logfiles and for saving in TDM format
- Portal object for specifying the view of the Data Portal, for displaying channel groups, and for selecting channels.
- Context menu object for user commands

Data Portal for managing the loaded and registered data

- Hierarchical organization of the data: Data sets, channel groups, and channels
- Managing numeric channels, waveform channels, time channels, and text channels
  - Implicit and explicit numeric channels
  - Move, copy, rename, and delete channels and channel groups
  - Creating new channels and groups with the respective properties
- Filtering the channel groups and channels to be listed
  - Pinning the channel groups and channels to be listed permanently
- Channel preview: Curve display of the selected channel
  - Playing audio data

Data properties

- Displaying data set, channel group, and channel properties
- Editing the properties
- Adding and deleting user-defined custom properties
  - Data sets, channel groups, and channels
  - Integer, numeric, date/time, and text formats
  - Template for custom properties
  - Saving event-related enumerations
- Managing and converting the channel units using the units catalog (refer to *Units Catalog*)

Internal data handling

- Dynamic data area that automatically enlarges for the data loaded in the Data Portal
- Data referenced by name or index of the channel group and of the channel
- Unicode characters, such as Asian and Cyrillic, in channel groups, channels, and the respective properties
- Optimized DIAdem storage management for handling large data sets
- DIAdem supports the reduced loading of TDM or TDMS files in sections of channels that contain more than 2^{31} values.

Saving data from the Data Portal with the drag and drop function

– TDM, TDMS, LVM, CSV, DAT, ASCII, Excel, WAV, ATF, and ATFX format and special formats via programming interface
– Mass data from TDM files in the space-saving data type of the original data

Advanced Data Management

CAN and Scripting functions.

CAN convertor for importing CAN logfiles

– Supports PCAN-Trace logfiles (`.TRC`) and the Vector-CAN database format (`.DBC`).

DataPlugins

– CodeCompletion and syntax coloring in the script editor
– DataPlugin wizard
  • Analyzing text-based data files
  • Creating DataPlugins in VBS

Data Mining for Work Groups

DataFinder Server Edition (DFSE): search engine for technical data in the company network.

Installing search engines for work groups on a server computer for access of several DIAdem clients

DataFinder Manager

– Creating and configuring DataFinder servers
– Starting and stopping DataFinder servers
– Pausing indexing
– Creating indexing schedules for every search area
– Optimizing user-defined custom properties

Access for several clients on one DataFinder server

– Exporting the connection settings as a URF file, including necessary DataPlugins
– Client installs the connection by double-clicking URF file
– DataFinder Server as Windows service
– Number of simultaneous connections depends on license

Indexing data files in the network

– Reading data properties
– Specifying folders to be indexed
– Automatically refreshing the index
– Manually starting the indexing of files and folders
– Client access via share folders

Indexing of archived data files

DataPlugins specify the indexable file formats

– Depending on the DataPlugin, the DataFinder server provides file properties, channel group properties, and channel properties, for the data search
– Optimizing user-defined custom properties to accelerate queries
– User-defined file formats can be added

Browsing to channel level in indexed files

Security settings

– Clients mine and browse only in search areas specified for the user
– Based on Windows share and security settings

Software requirements

– Windows Server 2003 32 Bit
– Windows Server 2003 R2 32 Bit
– Windows Server 2008 32 Bit
– Windows Server 2008 R2 64 Bit (as 32 bit application)

Graphical Interactive Data Evaluation

Viewing and editing data in 2D axis systems and tables in DIAdem VIEW.

Loading and saving VIEW layouts

– Adding layouts

Worksheets

– Several worksheets in one layout
– Manual worksheet partitioning
– Transferring VIEW worksheets to DIAdem REPORT

Scripting capabilities

– View object with subobjects and collections
– Context menu object for user commands
– Creating and editing objects with methods, events, and properties
– Note: *To create scripts you need at least the DIAdem Advanced Edition with Scripting.*

Defining areas as channel tables, 2D axis systems, contours, 3D models, maps, dialog boxes, images, and textboxes

– Switching between channel table view and 2D axis system view of the same channels

Channel tables

– Displaying all channels or specific channels or channel groups of the Data Portal
– Dragging and dropping channels and channel groups from the Data Portal
– Displaying and editing numeric channels, waveform channels, time channels, and text channels
– Block operations
  • Deleting, cutting, and copying data blocks over several channels
  • Overwriting and appending channel values
– Creating new channels

2D axis systems

– Defining curves by dragging and dropping channels and channel groups from the Data Portal
– Displaying numeric channels, waveform channels, and time channels
  • Lines, spikes, or stair curves
  • XY-channel pairs freely selectable
  • Waveform channels using their x-part
  • Numeric channels and time channels using their index
– Scaling
  • Linear, percent, or logarithmic
  • Automatic or manual
  • Several y-axes in one axis system
  • Several axis systems

– Evaluating curves with a crosshair cursor, a band cursor, or a frame cursor
  • Automatically following the curves with the player functions
  • Manually positioning the cursor
  • Cursor can be moved freely or on curve points, curve minimum values, or curve maximum values
  • Displaying the point number and the coordinates as cursor tooltip and in coordinates window
– Zooming, scrolling, and moving curve sections
  • Band zoom and frame zoom
  • Zooming with the mouse wheel
– Graphical data editing
  • Copying, deleting, and interpolating curve points or curve sections
– Background segments for event display parallel to the x-axis or the y-axis
– Curve labeling
  • Symbols or markers
  • Text from text channels
  • Enumerations from custom property
– Axis labeling with channel name and channel unit
– Configurable legend
– Displaying coordinates
– Playing audio data

Cursor synchronization

– The axis systems, contour displays, 3D models, videos, and maps of a worksheet are synchronized by default
– Defining cursor dimensions
  • Separately for each area
  • Synchronizing individual areas through the same cursor dimensions

Graphics areas

– Graphics for illustrations
– Zooming the graphic
– Graphics in the formats BMP, EMF, EPS, JPG, GIF, PCX, PNG, PSD, RAS, RLE, TGA, TIFF uncompressed, WMF

Textboxes

– Entering and displaying multiline text to comment evaluations and to display results
– Embedding DIAdem variables and data properties
– Dragging and dropping data properties from the Data Portal

Videos and Measurement Data

Creating areas with videos

Evaluating videos in AVI format, MPEG format, and MPG format

Zooming video sections

Using player functions

Synchronized evaluation of curves and videos

– Synchronization using index, or start time and frame rate
– Limiting the synchronization to curve sections

Note: *To display layouts that are linked to a video, you only need the DIAdem Base Edition.*

3D Display Contour

Creating areas with 3D displays as color shading and isolines

Displaying 3D data as color shading

– Color legend

Isolines

– Dynamic display of the isoline at the cursor position
– Creating individual isolines at the current cursor position
– Generating multiple isolines
– Labeling isolines with z-values
– Isoline display without color shading

Boundary curve limits the displayed surface

Calculating intersection curves in x direction and y direction at the current cursor position and saving them as channels

– Display in 2D axis systems

Evaluating curves and contour displays synchronously through cursor dimensions

Note: *To display layouts that are linked to a contour display, you only need the DIAdem Base Edition.*

Embedding User Dialog Boxes

Creating areas with user dialog boxes

Inserting SUD dialog boxes

– VIEWConnector control

Controlling other areas of the layout with properties and methods of the user dialog box

– Entering values
– Requesting settings
– Starting functions

Note: *To display layouts that are linked to a user dialog box you only need the DIAdem Base Edition.*

Maps and Measurement Data

Creating areas with maps

GPS data in GPX and NMEA format

Maps from OpenStreetMaps and Microsoft MapPoint

– Loading OpenStreetMap maps directly from the internet
– Saving the maps required for offline evaluations
– Zooming in and out of a map section and moving a map section
– Displaying the recorded circuit as a line

Evaluating curves and maps synchronously

– Synchronizing via longitude, latitude, and time track
– Using player functions

Note: *To display layouts that are linked to a map you only need the DIAdem Base Edition.*

3D Measurement Data Projection

Creating areas with 3D projection of measured data.

Measured data display on 3D models in VRML2 and STL format

– VRML2: Visual Reality Modeling Language, Version 2
– STL: Stereo Lithography

Linking the grid points on the model to channels

Displaying measured data as color shading and deformation

Moving, rotating, and zooming the model during a presentation

Note: *To display layouts that are linked to a 3D model, you only need the DIAdem Base Edition. You need DIAdem Professional Edition to manipulate the 3D model both manually and with a script.*

Report Generation

Creating reports with polar axis systems, 2D axis systems, 2D tables, graphics, and text in DIAdem REPORT.

Loading and saving REPORT layouts

- Uniform page size for all worksheets
- Page format with relative scaling or scaled in centimeters or inches
- Adding layouts
- Exporting as HTML document, PDF document, or PowerPoint presentation

Worksheets

- Several worksheets in one layout
- Specifying landscape format or letter format for each worksheet
- Optical highlighting of graphical objects under the mouse cursor
- Positioning the graphics objects anywhere
- Defining any order for overlapping graphic objects
- Exporting individual worksheets as a graphics file in the formats BMP, EMF, EPS, JPG, PCX, PNG, GIF, PSD, RAS, RLE, TGA, TIFF uncompressed, WMF
- Transferring REPORT worksheets to DIAdem VIEW
  - Converting 2D axis systems, 2D tables, and graphics

Chart wizard

- Creating and modifying 2D axis systems and polar axis systems in at least three steps: diagram type, channels, display

2D axis systems

- Displaying numeric channels, waveform channels, and time channels
  - XY-channel pairs freely selectable
  - Labeling the axes with text channels
  - Waveform channels using their x-part
  - Numeric channels and time channels using their index
- Displaying constants
- Interactive setting of coordinates
  - At certain curve points or at any position
  - x-, y-value and free comment
- Displaying all channels of one physical quantity in the same unit, and hiding channels that are a different quantity (refer to *Units Catalog*)
- Defining several y-axes in one axis system
  - Dragging and dropping channels and channel groups to subaxes
- Separate scaling for x-axis and y-axis
  - Interactive with the mouse
  - Autoscaling, DIN-conform scaling, manual scaling, scaled drawing
  - Scaling modes: linear, inverted, logarithmic, third, octave, probability, date/time, square, square root, and percentage for y-axis
- Transferring the scaling of a selected x-axis or y-axis or of the curve legend to a different 2D axis system of a layout
- Configurable, multicolumn curve legend
- Free axis labeling
- Transforming curves with user commands
- Background also with color shading
- Background segments for event display parallel to the x-axis or the y-axis
- Transferring a 2D axis system to DIAdem VIEW

Display modes for 2D data

- Curve
- Bars, differential bars, spikes, outlined bars
- Curve display with color palette and color legend
- Labeling curves with markers, text from text channels or text file, enumerations from channel custom properties
- Filled area under a curve or between two curves
  - Transparency can be specified for overlapping areas
- Single-sided or double-sided, horizontal and vertical error bars
  - Error calculation: percentage, standard deviation, standard error
  - Fixed value for all curve points or pointwise from channel
- Configurable line attributes
- Smooth curves

Polar axis systems

- Complete and partial circle display
- Labeling in degrees or radians
- Interactive scaling of the radius with the mouse
- Curve legend
- Angle direction either clockwise or counterclockwise

2D tables

- Display numeric channels, waveform channels, time channels, text channels, variables, and formula expressions
- Dragging and dropping channels from the Data Portal
- Display table contents on several pages
- Text list with static and dynamic texts independent of channels and scripts
- Horizontal or vertical alignment
- Formatting table columns and the heading, wordwrap
- Background also with color shading

Text

- Multi-line text with DIAdem variables and data properties
  - Creating text by dragging and dropping data properties from the Data Portal
- Comments with frames and arrows
- Text objects with paragraph format and character format, graphics and tables
- Formula graphics with frames and arrows
- Inserting special characters, symbols, and curve snippets

Decorations

- Circles, ellipses, rectangles
  - Background transparent or with color shading
  - Rectangles with shadow
- Lines, arrows, dividing lines
- Date, time, title, file name, page number
- Active table of contents with multi page reports

Background graphics, illustrations, company logos

- Graphics in the formats BMP, EMF, EPS, JPG, GIF, PCX, PNG, PSD, RAS, RLE, TGA, TIFF uncompressed, WMF
- Supports transparency of GIF, PNG, and TIFF graphics
- Embedding graphic or reference to graphic file

Formatting numbers in text and axis scales

- DIAdem format instruction
- Calling a user command

Format bar for interactive formatting of text, lines, and surfaces

User commands for automatic pre-processing and post processing of a report

Undoing editing steps

Displaying Unicode characters, such as Asian and Cyrillic

Create Master Layouts

Creating and linking master layouts.

Loading/saving master layouts

Separate layouts for portrait format and landscape format

Refreshing the linked master layout when a report is loaded

Exchange by loading another master layout

3D Graphics

Creating 3D axis systems and 3D tables in reports.

3D axis systems

- Dragging and dropping the x-channels, y-channels, and z-channels from the Data Portal into an axis system
- Surface definition
  - Based on several channels structured as a matrix (matrix structure)
  - Based on three channels (triplet structure)
- Define 3D curves with three channels
- Separate scaling for x-axis, y-axis, and z-axis
  - Interactive with the mouse
  - Automatic or manual
  - Linear, date/time, logarithmic
- Transferring the scaling of a selected axis or of the curve legend to a different 3D axis system of a layout
- Free axis labeling
- Configurable curve legend
- Color palette display with color legend
- Rotate 3D axis system in worksheet

Display modes for 3D data

- Surface
- Waterfall in x-direction or y-direction
- 3D curve
- Lines in x-direction and y-direction
- Bars, spikes, 2D matrix
- Various symbols, markers, point labels
- Characteristic diagrams with labeled extreme values, boundary curves, and isolines

2D and 3D vector diagrams

- Displaying a vector with the specified length and direction in each point
- Position in cartesian coordinates or spherical coordinates
- Scalable vector length

3D tables

- Dragging and dropping the x-channels, y-channels, and z-channels from the Data Portal into an axis system
- Horizontal or vertical orientation
- Formatting table contents automatically or manually

Note: *To display layouts which contain 3D axis systems and 3D tables, you only need the DIAdem Base Edition*.

Mathematical Data Analysis

Calculating channels and single values in DIAdem ANALYSIS using the Calculator and the function libraries.

The mathematical functions in DIAdem ANALYSIS can process numeric channels, waveform channels, and time channels.

- In waveform channels DIAdem uses the x-values defined as a generation instruction
- Calculations with different settings and preview of the results in the dialog box

Result storage depending on function

- Creating new result channels
- Overwriting the input channels
- Copying single values to the clipboard
- Saving single values in DIAdem variables
- Saving characteristic values as custom properties of channels

Curve Fitting

- Smoothing with a specifiable smoothing width
- Savitzky-Golay Filter
  - Smoothing width and polynomial order
  - Weighting channel
- Linear Mapping
  - Analog, spike, or stair display modes
  - Extrapolation
- Calculating the upper and lower envelope curves

MathScript

- Registering and calling scripts with LabVIEW MathScript for mathematical analysis
- Note: *This functionality requires NI LabVIEW with* MathScript.

Calculator

Defining user-defined formulas to calculate channels and single values.

The Calculator is also available in DIAdem VIEW and DIAdem SCRIPT

Operations, channels, and variables can be selected directly

Formulas can be recalled

Creating formulas in VBS syntax

Mathematical operations

- Basic mathematics and random values
- Comparison operations and Boolean operations
- Trigonometric, logarithmic and exponential functions
- Bit calculations and shifts
- Absolute value, sign function, factorial, rounding
- Filtering partial time formats
- Converting degree to radian and vice versa

Text operations

- Text addition, comparison operations
- Text conversion into upper/lower case and into numeric types
- Copying and deleting text
- Determining text lengths and character positions

Find function for numeric event isolation

Folder and file functions

Data Portal functions

Basic Mathematics

Basic mathematical functions.

Adding, subtracting, multiplying, and dividing channels

Scaling channel values

Offset correction

Calculating reciprocal values

Normalizing channel values to 1

Relativizing channel values to the sum of the channel values

Calculating differences between consecutive channel values

Summating channel values

Differentiating and integrating

RMS

Channel Functions

Generating and calculating channels.

Generating numeric channels and time channels

Converting numeric channels into waveform channels and vice versa

Calculating mean values of several channels

Converting units

- Converting a channel to a different unit of the same quantity
- Converting several channels into the units of a specified unit set (refer to *Units Catalog*)

Sorting channel values

- Sorting control channel in ascending order
- Sorting values from other channels in the same order

Peak search

– Determining local minimum values and maximum values

NoValue handling

– Interpolating, deleting, or replacing outliers

Quantizing

– Mapping channels on the integer data types 8-bBit, 16-bit, or 32-bit

Statistics

Calculating statistical characteristic values of process capability and of frequency distributions.

Descriptive statistics

– Minimum, maximum, sum of measured values and measured value squares
– Lower/upper quartile (0.25/0.75 quantile), median (0.5 quantile)
– Arithmetic mean, geometric mean, harmonic mean, and quadratic mean
– Average absolute deviation from mean and from median
– Dispersion: range, quartile distance, standard deviation, standard error, variance, variation coefficient, relative variation coefficient
– Form: skewness, kurtosis
– Calculations channelwise or rowwise over several channels
– Formatted display of the characteristic values as text in a report
– Saving characteristic values in DIAdem variables and in the custom properties of the input channels

Method for data reduction and classification

– Data reduction within defined classes to minimum, maximum, number of values (histogram), sum, or mean
– Classification with simultaneous analysis of dependent channels
– Histogram classification

Regression

Calculating regression functions with selectable setup functions.

Setup functions

– Linear, exponential, logarithmic, and power terms
– Exponential setup function and power setup function, with and without weight adjustment

Calculating coefficients and coefficient of determination

Result preview

– Display of the coefficients and calculated curve

Units Catalog

Managing channel units in the units catalog.

The units catalog contains

– Unit sets, such as SI units
– Physical quantities, such as length
– Units, such as meter
– Symbols, such as m

Adding user-defined unit sets, quantities, units, and symbols to the units catalog

Loading and saving units catalogs

– Importing new units

Converting units

– Converting a channel to a different unit of the same quantity
– Converting several channels into the units of a specified unit set

Quantity-based calculations

– Can be enabled for all calculations
– Available in the Calculator and all DIAdem ANALYSIS functions
– Automatic units adjustment in the calculation
  • 5m+3cm=5.03m
– Specifying the result quantity and result unit
  • 0.01N/10mm^2=1000Pa

Scripting capabilities

– Units object with methods and properties
– Creating and editing unit sets, physical quantities, and units

Calculation Manager

Creating and managing calculation templates.

Calculation templates contain the calculation instruction and the data references.

– Calculations with simple formulas, calculator functions, user commands, and ANALYSIS functions
– Calculating with single values, channels, channel lists, and variables and properties
– Graphical formula display
– Defining calculation chains where calculations require the results of other calculations

Validation of the data references of the calculations

Creating and managing the calculations in the calculation manager

– Organizing in calculation groups
– Saving and encrypting the calculation instructions in a calculation set
– Loading and appending calculation sets

Executing repeatedly to evaluate measurement sequences

Scripting capabilities

– Calculation set object with methods and properties
– Creating and processing calculations, calculation groups, and calculation sets
– Assigning input data and result data

Note: *To execute calculation templates you only need the DIAdem Base Edition.*

Process Capability

Calculating the statistical process capability.

– Process capability indexes C_p, C_{pk}, C_{pL}, and C_{pU}
– Mean values and standard deviations of the process
– Estimations of the number of parts with errors
– Saving process characteristic values in DIAdem variables and in the custom properties of the input channels

Approximation

Calculating approximation functions with configurable setup functions.

Setup functions

– Polynomial and rational functions
– Exponential and root functions
– Logarithmic functions

Calculating the coefficients of the setup functions using the Gaussian least squares method

– Calculating the coefficient of determination
– Saving results in DIAdem variables and in the custom properties of the result channels

Evaluation points of the approximation curve to be generated can be specified

Result preview

– Display of the coefficients and calculated curve

Splines

Calculating parametrical splines, non-parametrical splines, and Akima subsplines.

Non-parametrical splines

– Natural, approximating, periodic, and rational spline types
– Weighting factor for approximating and rational splines

Parametrical splines

– Natural, approximating, and periodic spline types
– Weighting factor for approximating splines

Akima subsplines

– Approximating and interpolating spline types
– Regression calculation for approximating splines depends on the number and weighting of the neighboring interpolation points and the compensation range

FFT

Fast Fourier Transformation of one time signal or two time signals.

Input channels of any length, which means the channel length need not be a power of two

FFT of one time signal

– Real/imaginary part, phase, cepstrum
– Amplitude calculation with averaging
– Third/Octave analysis
– Multiple FFT
  • Defining intervals
  • Using multiple channels

Inverse FFT

– Phase shift for Hilbert transformation

FFT of two time signals

– Cross spectrum
– Coherence
– Transfer frequency response: H0, H1, H2 spectrum
– Amplitude calculation with averaging
– Multiple FFT
  • Defining intervals
  • Using multiple channels

Autocorrelation

– Normalized and non-normalized
– Calculating in frequency domain or time domain

Cross-correlation

– Normalized and non-normalized
– Calculating in frequency domain or time domain

Window functions

– Rectangle, Hanning, Hamming, Blackman, Flat-Top, Cos10Percent, Welch, Parzen, Bartlett, de la Vallee, Riemann, Kaiser, Cauchy, Gauß, Exponential
– Freely definable window function
– Amplitude damping correction of the window function for periodic and random signals

Digital Filters

Damping or amplifying selected frequencies with IIR and FIR filter methods.

Filter types

– Highpass, lowpass, bandpass, bandstop, allpass

Infinite Impulse Response (IIR) filters

– Filter type: Bessel, Butterworth and Chebyshev
– Ripple for Chebyshev between 0.01 and 3 dB
– Filter degree 1 to 16
– Phase shifting and offset can be eliminated

Finite Impulse Response (FIR) filter

– Window function: Rectangle, Hanning, Hamming, Blackman, Bartlett, modified rectangle

Shock Response Spectrum

Describes the response of multiple single-degree-of-freedom systems to an acceleration signal.

Calculation of

– Acceleration
– Relative velocity
– Relative displacement
– According to ISO-Norm 18431-4:2007

Logarithmic display over the frequency

Calculation for the entire acceleration signal or for a section

Damping of the single-degree-of-freedom systems

3D Mathematics

Order, conversion, and copying functions for matrices. Generating and analyzing surface data.

3D basic functions

– Processing data in matrix structure or triplet structure
– Creating partial matrices and appending matrices
– Sorting and transposing

Mathematical 3D functions

– Relativizing, normalizing, extreme values
– Calculating the integral under a surface
– Calculating sum of matrix elements
– Arithmetic matrix operations

Generating and analyzing surfaces

– Calculating convex and non-convex boundary curves
– Multi-dimensional approximation from matrix or triplet structure
  • Setup functions from polynomial, rational, exponential, radical, and logarithmic functions
  • Calculating the coefficients of the setup functions using the Gaussian least squares method
– Multi-dimensional interpolation
  • Interpolation method: inverse distance, multiquadrite, ThinPlate, bicubical splines, Smart Interpolating Spline
– Calculating isolines

Circle Regression

Calculating circles and Q-values.

Calculation of

– Regression circles
– Maximum incircles and minimum circumcircles
– Extremal concentric incircle and circumcircle

Q-values as degree of radical dispersion of measured values around approximated circle

Curve Fitting

Approximating a set of points with a non-linear function or a Gaussian curve.

Non-linear curve fitting

Specifying a setup function in VBS syntax

Calculating the coefficients with the Levenberg-Marquardt algorithm

- Calculating mean squared error
- Saving coefficients and errors in DIAdem variables
- Saving curve values
- Weighting

Result preview

- Display of the coefficients and calculated curve

Gaussian curve fitting

Calculating the center, the amplitude, and the standard deviation of the Gaussian curve

- Least squares method
- Least absolute residual method
- Bisquare method
- Weighting

Result preview

- Display of the coefficients and calculated curve

LS Linear Fitting

Calculating a k-dimensional curve by minimizing error squares.

Calculating coefficients using SVD, Givens, Cholesky, Householder, or LU decomposition methods

- Calculating covariance matrix
- Weighting

Result preview

- Display of the mean squared error and fitted curve

Frequency-Weighted Acceleration

Analyzing the effects of mechanical vibration on the human body in accordance with ISO 2631 and ISO 5349.

Evaluation types

- Wk: Vertical whole-body vibration z-axis (ISO 2631-1)
- Wd: Horizontal whole-body vibration x-axis or y-axis (ISO 2631-1)
- Wc: Horizontal whole-body vibration x-axis (ISO 2631-1)
- Wf: Low-frequency vertical whole body vibration z-axis (ISO 2631-1)
- We: Rotating whole-body vibration (ISO 2631-1)
- Wb: Vertical whole-body vibration z-axis (ISO 2631-4)
- Wj: Vertical head vibration (ISO 2631-1)
- Wh: Hand-arm vibration (ISO 5349-1)

Average filter results using a floating RMS with data reduction

Order Analysis

Order analysis in the time domain or the frequency domain.

Order analysis in the time domain through digital filtering (tracking analysis)

- Third/Octave analysis
- Sum level calculation
- In accordance with DIN 45651 and DIN 45652

Order analysis in the frequency domain

- RPM-controlled frequency analysis for the definition of rpm-dependent vibrations
- FFT analysis

Evaluation: linear, dB, dB(A), dB(B), dB(C)

Data reduction in relation to time or rpm

Extended Classification

Classification method with one parameter in accordance with DIN 45667.

Sample counting, time-at-level counting, level crossing counting, maximum value memory, range counting, range pair counting, peak value counting

Compound classification

- Sample counting, maximum value memory counting, and time-at-level counting

Relative or absolute class frequency calculation

Parameters depend on the selected method

- Hysteresis
- Single frequency or cumulative frequency
- Reference line and clock specification

Rainflow Analysis

Two-dimensional classification of signals according to directives from the Research Association for Drive Engineering (FVA), `www.fva-net.de`.

Calculating rainflow matrix and transition matrix

- Closing or including residues

Extracting single-parameter classifications from the result matrices

- Level crossing counting, range and range pair counting
- Single frequency or cumulative frequency

Hysteresis

Crash Analysis

Crash test analysis for vehicle safety according to SAE and ISO specifications as well as statutory directives, for example, FMVSS and ECE.

Calculating the resultant acceleration from the acceleration values in the x, y and z-directions

Filtering with CFC60, CFC180, CFC600, CFC1000, FIR100

– In accordance with ISO/TC22/SC12/WG3 N 260 and SAE J211 (12.2003)

HIC calculation (Head Injury Criterion)

– Either HIC, HIC36 or HIC15 including start/end time of the time interval
– In accordance with SAE J2052
– In accordance with ISO/TC22/SC12/WG3 N 282 (Issued 1990-03-16)

HCD calculation (Head Contact Duration)

– HCD value, HCD36 value, HCD15 value, or HCD XY value
– In accordance with SAE J2052
– In accordance with ISO/TC22/SC12/WG3 N 282 (Issued 1990-03-16)
– In accordance with TRANS/SC1/WP29/GRSP/R.48/Rev.1, page 19, Annex 4, Appendix 1

HPC calculation (Head Performance Criterion)

– HPC value, HPC36 value, HPC15 value, or HPC XY value
– In accordance with SAE J2052
– In accordance with ISO/TC22/SC12/WG3 N 282 (Issued 1990-03-16)
– In accordance with E/ECE/24; E/ECE/TRANS/505; Regulation No. 95; page 34; Annex 4, Appendix 1

NIC calculation (Neck Injury Criterion)

– In accordance with ECE R94 and EuroNCAP

NIC rear impact calculation

– In accordance with ISO/TC22N2071 and ISO/TC22/SC10

NIJ calculation (Normalized Neck Injury Criterion) in accordance with FMVSS

VC calculation (Viscous Criterion)

– In accordance with ECE 94: directive 96/79/EG (16th 12 96)
– In accordance with SAE J1727: n. SAE J1727 (8.96)

TTI calculation (Thorax Trauma Index)

– Maximum rib acceleration
– Peak acceleration of the spine (T12)
– In accordance with FMVSS No. 214, §571.214
– In accordance with SAE J1727 3.5

CWV calculation (Chest Wall Velocity)

– Speed of the pressure wave which crushes the chest wall

DRI calculation (Dynamic Response Index)

– Crushing chest and lumbar spine

FFC calculation (Femur Force Criterion)

– In accordance with ECE R94 and EuroNCAP

TI calculation (Tibia Index)

– Inclusion of bending moments around the x-axis and the y-axis
– Inclusion of axial force of pressure in z-direction
– In accordance with directive 96/79/EG (16th December 96); Amendment 2; 5.2

Xms value: maximum amplitude value of x milliseconds

– Saving the start time of the x ms value
– Partitioned or complete time intervals

Xg value: total time during which the acceleration exceeds X[g]

– Partitioned or complete time intervals

Guardrail criteria in accordance with 1317-1(7.98)

– ASI calculation (Acceleration Severity Index)
– THIV calculation (Theoretical Head Impact Velocity)
– PHD calculation (Post-Impact Head Deceleration)
– OIV calculation (Occupant Impact Velocity)
– ORA calculation (Occupant Ridedown Acceleration)

Calculating the minimum values and maximum values with the related times

Calculating the pulse limit

AComp calculation (acceleration during compression phase)

Copying time domain

Offset correction

Inverting channel values

Dividing a channel at a limit value

Supporting exchange formats such as ISO-MME for crash data

Scripting

Automating processes with VBS in DIAdem SCRIPT.

Script functions

– DIAdem functions, commands and variables
– All VBS commands, including ActiveX and global variables
– Procedures, functions, and classes
– Control structures with branches, loops, and pauses
– User-defined variables
– Interaction: interrupting a script for interactive operation of DIAdem
– Communication via OLE, ODBC/SQL, ASAM-ODS and ActiveX interface
– Start LabVIEW VIs
  • Object-oriented interface
  • DIAdem installs LabVIEW runtime engine
– Commands for accessing databases (SQL/ODBC, ADO)
– Commands for the download of FTP servers
– DataPlugin wizard
  • Analyzing text-based data files
  • Creating DataPlugins in VBS

Script editor with debugger

– Creating scripts in the recording mode
  • Path variable records all used folders
– Syntax coloring
– CodeCompletion offers the available objects, commands, and procedures for selection
  • Supporting user-defined VBS classes (Class) and parameters transferred to functions
  • Supporting registered type libraries
– SmartInfo with syntax, type, short description and link to the Help for commands, properties, methods, and variables
– Debugging for testing and for detecting errors
  • Breakpoints, bookmarks, jumps
  • Displaying variable contents and errors
– Collapsing/Expanding code blocks

Note: *You do not need to install the Visual Basic Scripting Host to create and execute scripts. DIAdem uses an integrated script engine. You do need to install the Microsoft Windows Script Debugger to debug scripts.*

Note: *To execute scripts you only need the DIAdem Base Edition.*

Creating User Dialog Boxes

Creating modal and non-modal dialog boxes using VBS.

- User must close modal dialog boxes for script to continue
- Non-modal dialog boxes can remain open

Graphical dialog box editor

- Catalog with dialog box modules
- Tabs for multipage dialog boxes
- Selection fields, input fields, list fields, and marking fields
- Checkboxes and radiobuttons
- Spinboxes and comboboxes
- Listboxes with multiple selection
- Dragging and dropping channels to channel combobox and channel listbox
- Text, buttons
- Graphics and frames
- Tables for displaying and entering variable contents
- Extended tables for displaying and using controls such as radio buttons, checkboxes, comboBoxes, editboxes, listboxes, channel comboboxes, and channel listboxes
- Embedding ActiveX elements
- Minimizing, maximizing, and hiding in title bar
- Preview and test functions

Syntax coloring, CodeCompletion, and SmartInfo in the script editor

Transferring variable contents

VBS for defining logical operations

Saving several dialog boxes of a project in one file

Encrypting scripts and dialog boxes

Note: *To execute user dialog boxes you only need the DIAdem Base Edition.*

Bar Manager and User Commands

Extending the program interface and the command stack.

Adding functions and function groups to the user interface

- Showing and hiding the toolbar, the panel bar, the group bar, and the function group
- Changing the display of the bars and the function groups
- Creating and removing function groups
- Adding buttons to the function groups and the toolbars
- Assigning user-defined functions to the buttons

User commands

- Definition in VBS scripts
- User-defined, permanent extensions to the DIAdem range of functions, for example, for special calculations or formats
- DaisyChaining: Assigning multiple user commands to one event

Modifying standard menus and adding user-defined menu items

Note: *To execute user-defined program interfaces and user commands you only need the DIAdem Base Edition.*

System Requirements

Software requirements

- Windows XP Pro Service Pack 3 or later
- Windows Vista 32 Bit with Service Pack 2
- Windows Vista 64 Bit with Service Pack 2 (as 32-bit application)
- Windows 7 32 Bit
- Windows 7 64 Bit (as 32 bit application)
- Windows Server 2003 R2 32 Bit
- Windows Server 2008 R2 64 Bit (as 32-bit application)
- Internet Explorer Version 6.0 Service Pack 1 or later
- Recommended: Adobe Reader and Adobe Flash Player for Microsoft Internet Explorer

Hardware requirements

- CPU: x86 compatible processor, at least 1.6 GHz
- Memory: At least 1 GB
- Hard disk: At least 2.2 GB free memory space of which at least 1.3 GB are on the system partition
- Graphics card: color depth at least 16 bit (High Color), recommended 24 or 32 bit (True Color)
- Screen resolution: At least 1024x768

NATIONAL INSTRUMENTS™

11500 North Mopac Expressway
Austin, TX 78759-3504 USA
Tel: (512) 683-0100 ● Fax: (512) 794-8411
Email: info@ni.com