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RS SigEdit – A module of RS LabSite®

Advanced Graphical Display and Editing

INSTRON STRUCTURAL
TESTING SYSTEMS

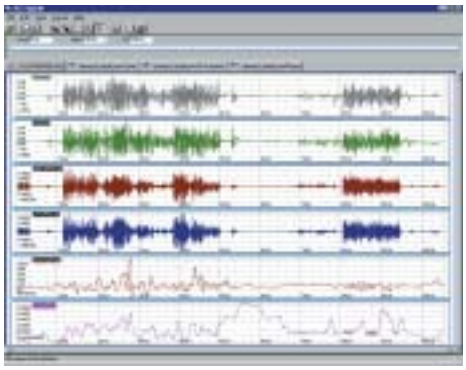
Expanding your Signal Editing Capabilities

The RS LabSite® suite of software offers two applications for data viewing and editing, the Viewer and RS SigEdit. The Viewer, a standard element of the RS BasLab package, is a comprehensive data viewer with basic editing features. RS SigEdit extends the capabilities of the Viewer with advanced editing and signal processing functions. Both are Windows® applications designed to provide users with maximum capabilities for minimal effort.

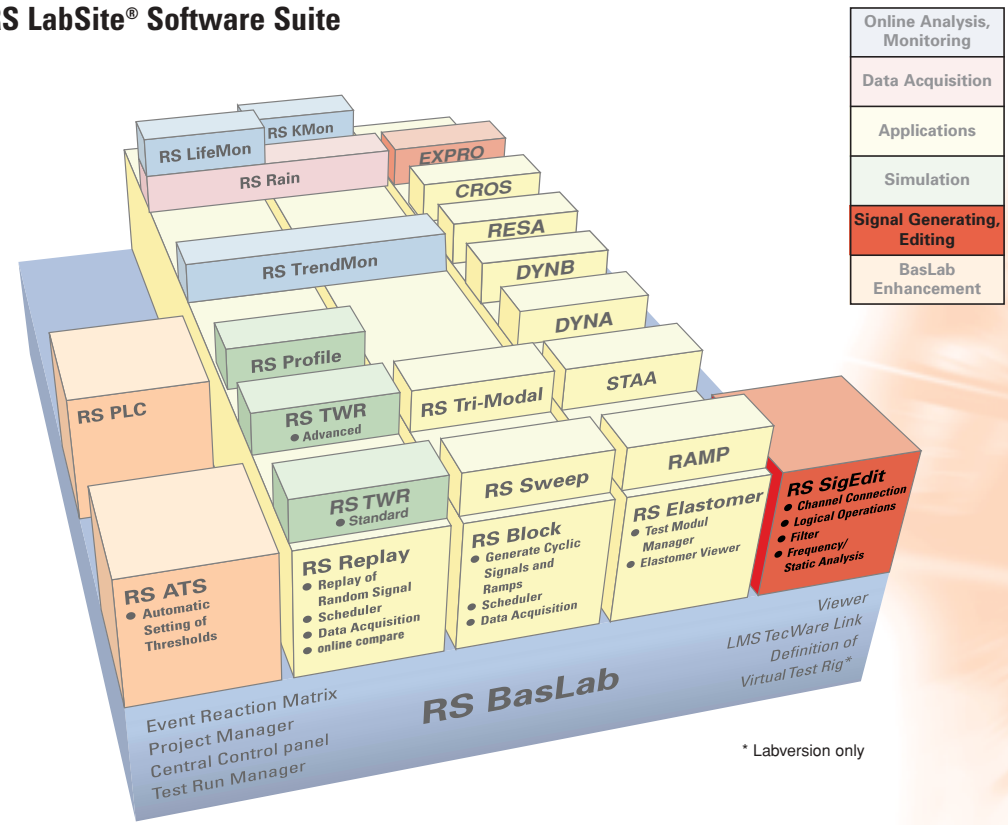
Viewer Display

The Viewer display consists of one or more pages, arranged as tabbed windows and showing several plots. Each plot has one or more traces of multiple time history data channels or spectral functions. The page zoom tools allow the user to view one, several or all plots on a page, and to scroll effortlessly around a page.

The main window can be split to show two pages alongside each other. A unique feature allows one page to be used to navigate through a multi-channel file while the other one shows a single selected channel.



RS LabSite® Software Suite



RS LabSite® Environment

The Viewer is fully integrated into the RS LabSite® software suite. Data files can be viewed simply by double clicking in RS LabSite® Project Manager, or alternatively by opening them from the Viewer in the RS LabSite® or Windows® environments.

The Viewer displays data generated not only from RS LabSite® files but also from a wide range of other formats, using a unique built-in data import/export feature.

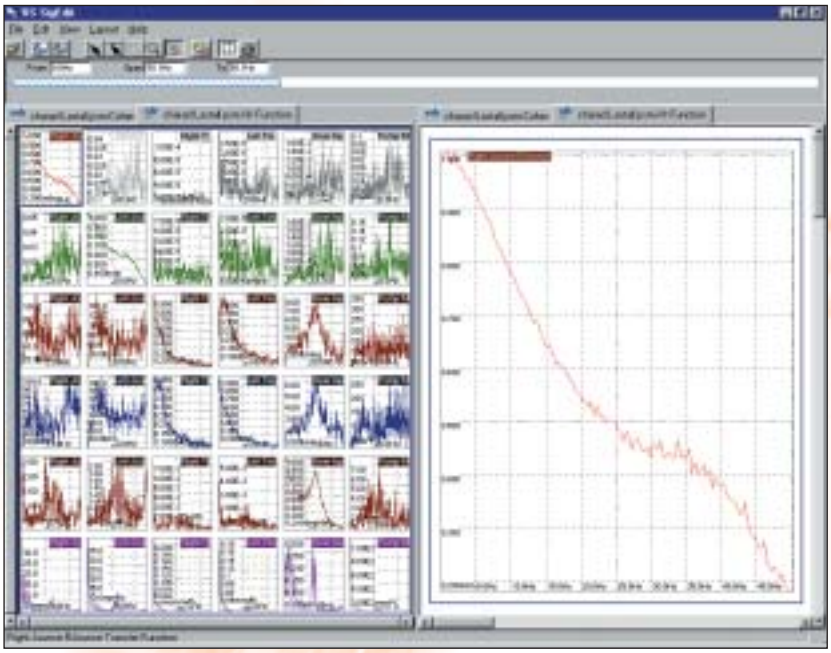
Available formats include:

- DATs
- DECAT
- Excel
- LabSite® VMS
- Matlab
- MegaDac
- nCode
- nSoft
- RPC 2/3
- Servotest
- Text
- Diadem
- EDAS
- EMPA

Additional formats can also be easily included.

In addition to plotting time history data from RS LabSite® files and a wide range of industry standard file types, the Viewer also plots data from spectral, transfer function and inverse transfer function files. Time history data may include digital channels as well as standard analog. The user can set up and store comprehensive plot configurations. These can be subsequently recalled and applied to different files, allowing the creation of user specific formats, or plots to be tailored for specific applications.

A number of scaling and zooming tools are provided to allow easy re-scaling of plots. These, for example, enable the user to quickly view short sections of data or the complete signal, and support both linear and log scales. Traces can be moved between plots and plots re-arranged on a page using familiar "drag and drop" techniques. The page layout can also be changed.



RS LabSite® data files include named sections, typically used to identify a specific road surface or to contain a snapshot of acquired data. The data within a section is continuous but may not be continuous across sections.

The Viewer can display all file data or just sections, depending on requirements. These sections can be created, modified or deleted by the user.

Data files and channels can be overlaid, allowing the user to quickly examine differences between channels and, for example, to check whether desired and achieved simulation responses are similar.

A properties window allows viewing and changing of the properties of pages, plots and data files. Statistical properties of channels, for example, means that maxima and standard deviation, can also be viewed.

A full set of printing and copying tools are provided. Plots can be printed with headers, footers and other typical print features, and statistical summaries can be added to printed pages. Plots can also be copied to other Windows® applications, enabling them, for example, to be included in standard reports.

Data Editing

Basic Editing – Viewer

The Viewer includes basic time-domain editing features, which most users find sufficient for preparing test application data. These basic editing features mainly consist of copy and paste actions, data scaling and tapering.

Mark Tool

The Viewer incorporates a unique set of Mark tools, which allow one or more regions in time to be defined. Editing operations are then applied either to the marked regions or to all data in a file.

Cutting and Keeping

Regions of a time history file, identified by marks, can either be discarded (Cut) or retained (Keep). Where discontinuities are created smoothing tapers can be specified. Data files may be shortened or lengthened using a File Length command.

Preview Feature

A preview feature allows the user to see the effect of an edit before committing to it. This is available for most editing operations.

Copying and Pasting

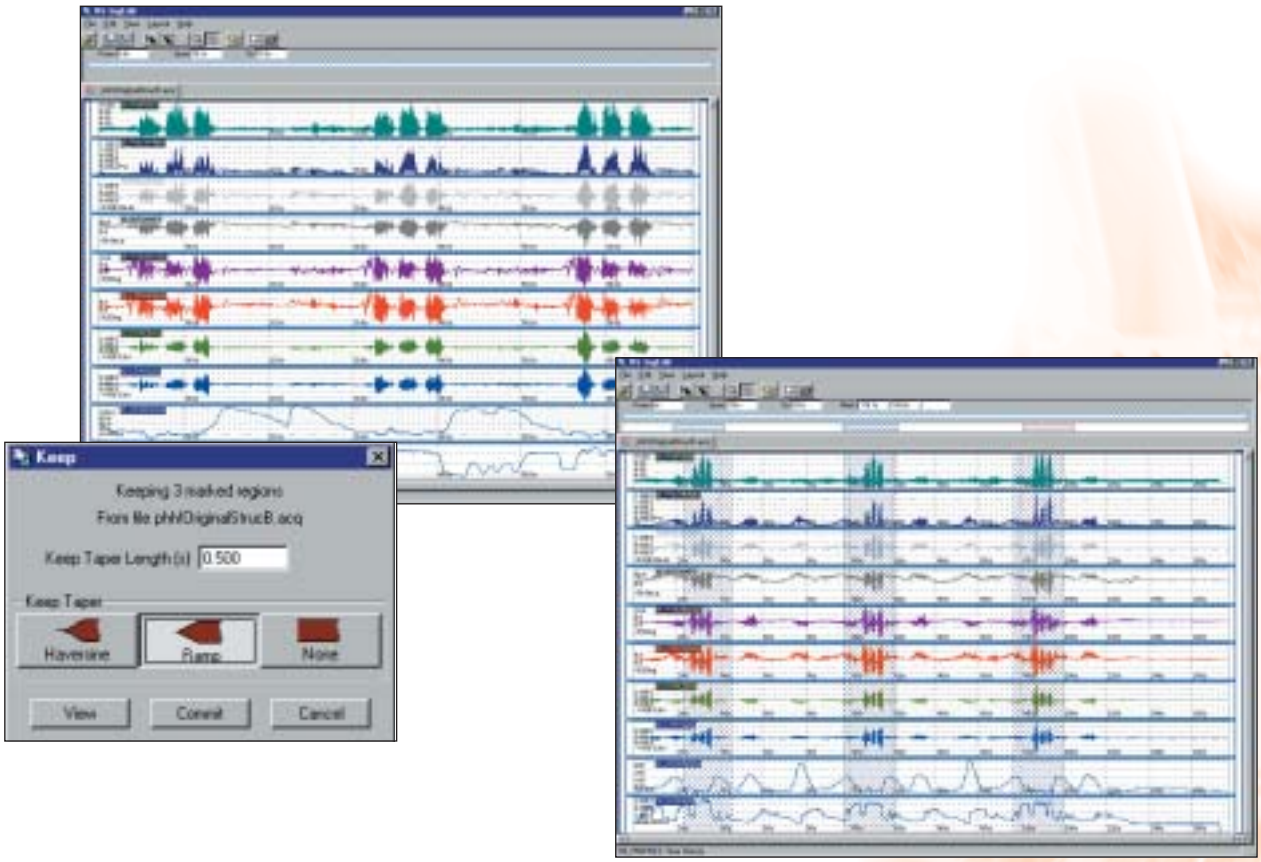
Channels and regions in time may be copied and pasted into an existing file or to a new one. The pasted regions can be joined onto the beginning or the end of existing data, or merged as additional channels. Smoothing tapers may be applied at any joins. Channels can also be deleted from a file.

Scaling

Data channels can be scaled and offsets applied. This feature can be applied to a marked region allowing the user, for example, to scale down a particular severe event whilst retaining full signal amplitude throughout the remaining data.

End Tapers

Tapers may be applied at the start and end of a time history data file to avoid starting and finishing transients.



Advanced Editing – RS SigEdit

RS SigEdit offers a number of advanced editing features for time history and frequency domain files not available in the Viewer.

These include:

Filters

Flat band pass or notch filters can be applied to a complete file, regions of a file and/or to selected channels.

Re-sample tool

RS SigEdit enables the re-sampling of data files up or down. When down sampling, a low pass filter is automatically applied to avoid data aliasing problems.

Interpolation

An interpolate feature allows, for example spikes to be marked and then removed from selected data channels

Stretching or Compressing

A unique RS SigEdit feature allows regions of a time history file to be stretched or compressed in time. This, for example, enables a rapidly changing signal to be slowed down, so that it is within the capabilities of a test rig to reproduce it. Alternatively a signal can also be speeded up to reduce testing time.

Clipping

Maximum and minimum values of a time history signal can be limited by clipping a data channel to within specified limits.

Mathematical Operations

New data channels can be created by combinations of existing ones. Operations to create normal analog channels include add, subtract, multiply and divide. Logical operations (e.g. or, greater than, and) are available to create digital channels.

Analog and Digital Channel Conversion

Analog channels can be directly converted to digital. Digital channels can also be converted to analog.

Frequency Domain Data

RS SigEdit calculates and plots spectral and transfer function data. This data can also be edited with operations including interpolate, scale and set data to specified values. Operations can be applied to selected channel pairs and within marked regions.

Advanced Processing

Time History Manipulation Modules

This set of tools is used to edit multi-channel sampled time history data.

Time History Merge

This application merges two multi-channel time history datasets into a single time history dataset with all channels.

Time History Append

Time History Append appends a second time history dataset onto the end of a first time history dataset to form a single longer output time history dataset.

Time History Extract

This extracts a section of time history data from a dataset and puts it into a new output dataset. The data extracted can be a subset defined either by the channels in the input dataset, or the time of data, or both. The program can also be used to compress data by skipping data points. It can start the extraction of data from a trigger point based on data in one channel of the input dataset.

Frame Size Change

Frame Size Change creates an output dataset which can have a different frame size to the input time history dataset. The frame size determines the spectral resolution in the frequency domain.

Filter Data

Filter Data takes an input time history dataset and filters, integrates or differentiates it using a convolution based method to produce an output time history dataset. A user filter option filters to a set of points defined as a 'diagonal only' frequency response function. Other functions are as follows:

- Butterworth filter
- Bessel filter
- Chebyshev filter - 0.1 dB ripple
- Chebyshev filter - 0.5 dB ripple
- Chebyshev filter - 1.0 dB ripple
- Chebyshev filter - 2.0 dB ripple
- Chebyshev filter - 3.0 dB ripple
- Flat filter, i.e. pass in specific band
- Notch filter, i.e. reject in specified band
- Single and double differentiation
- Single and double integration

Basic Filter

Basic Filter takes an input time history dataset and filters it with a flat band pass filter between user defined upper and lower frequency limits. It provides a quick and easy-to-use alternative to Filter Data for a basic filtering operation. All data channels are filtered.

Remove Mean

Remove Mean removes the mean value from all data in a time history dataset. The mean value is first calculated and then subtracted from each channel in turn. All other data channel properties remain unchanged.

Taper Data

Taper Data applies a cosine taper of user specified duration to both ends of all channels in a time history data set.

Multiply-Add

Multiply-Add creates a number of output time history signals *'y'* which are created by applying mathematical functions to a number of input channels *'x'*, such that:

$y_n^{(t)} = a.x_m^{(t)}$

where *'a'* is a linear transformation matrix of the order n x m. The elements of *'a'* may be set by the user.

Using this program, data may be scaled or 'sum and difference' channels created.

Polynomial Transformation

Polynomial Transformation transforms signals based on a polynomial equation or a user supplied function.

It is used typically for linearization to time history data.

The program transforms a set of time history signals to produce a new set of signals. Each output signal is calculated from a single input signal, i.e. there is no cross-coupling between channels. The transformation is defined either by a polynomial curve or by a user supplied curve.

Linearization can take place using either the defined polynomial or its inverse.

Time History Combine

Time History Combine takes two input time history datasets and combines them to produce a single output dataset.

The user can scale both input time histories by using simple multiplication constants C_1 and C_2. Time History Combine is primarily designed to compute response errors and to update drive signals for use in simulation applications.

The combination uses the following equation:

$y^{(t)} = x_1^{(t)}.C_1 + x_2^{(t)}.C_2$

Analysis Modules

This set of modules performs analysis on existing files.

Spike Removal

The purpose of Spike Removal is to search a dataset channel-by-channel for spikes recorded due to interference during data acquisition. A spike is defined in terms of the gradient of the line joining two points. The routine calculates the standard deviation of all gradients between points, then sets a gradient limit based on the standard deviation. If the gradient between two points is greater than the limit, the second point is deemed unacceptable. Short transient spikes consisting of a few data points are removed. If the program finds longer transients, the user is informed but the data is left unaltered.

Statistical Analysis

The Statistical Analysis program calculates the statistical properties of a Time History dataset and stores the results in a statistics dataset.
Statistics calculated are:

- Mean value
- Minimum value
- Maximum value
- Range value
- Standard deviation value
- Kurtosis value
- Skewness value
- Mean zero up-crossing period
- Mean period of peaks
- Fatigue damage

Spectral Analysis

The Spectral Analysis program performs a fourier spectral analysis of a time history dataset to produce a cross-spectral matrix dataset of results. The cross-spectral matrix dataset is the starting point for a wide range of frequency domain operations. The computation process is:

a) A single sided fourier transformation is undertaken on each frame of data for each active channel. A window is optionally applied before transformation.
b) For each specified signal pair, the fourier transforms are multiplied together for each frame, then the resulting product is summed for all frames to produce the cross-spectrum estimate.
c) Finally the spectrum is converted into a spectral density in engineering units and stored in the output dataset.
d) As the cross-spectral matrix is 'hermitian', only the active spectral pairs lower in the diagonal half of the matrix are stored.

Frequency Response Function Analysis

The frequency response function (FRF) program produces an output FRF matrix from a cross-spectral matrix. It is intended for use in multiple input, multiple output (MIMO) applications. The conditioned FRF matrix stores relationships between a set of input channels (drive) and a set of output (response) channels in which the effects of all other inputs have been removed.

FRF Analysis is used to identify relationships between signals. Partial coherences, multiple coherences and frequency response functions from an FRF matrix can be viewed using Viewer.

Data Generation

Time history files may be generated using the Data Generation module available from Viewer. This can create multiple sections of data for subsequent use by RS LabSite®. Data types that can be generated include:

- Regular Periodic
- Swept Sine
- Random

Plot Types

The Viewer produces a number of different types of plots, based on time history and frequency domain files.

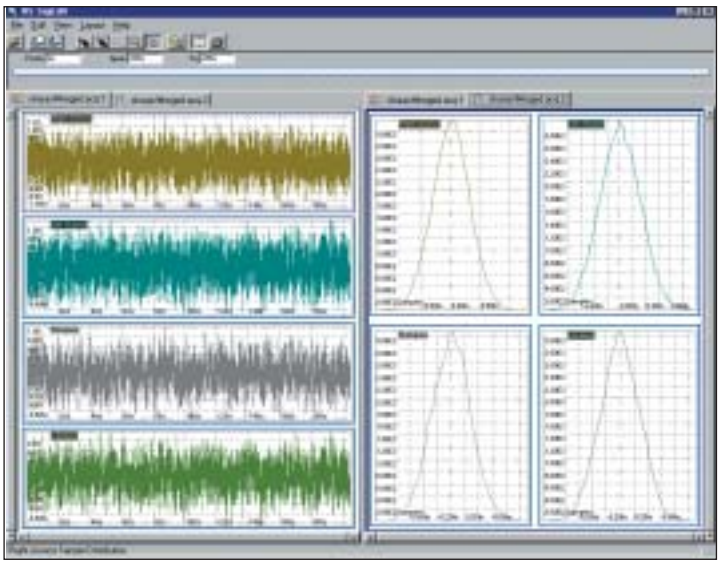
Time History Plots

The most common type of plot is a time history. It displays the value of a signal on the vertical axis against time on the horizontal axis, based on data stored in time history files.

Real Time Plots

A real time plot is a special time history plot, which displays time history data in real time.

Real time data is available when the RS LabSite® data acquisition server is running. Plots are updated frequently to show a portion of the latest data available. A snapshot of real time data may also be captured and subsequently saved to a time history file.



Distribution Plots

Amplitude distribution and level-crossing distribution plots can be created from time history data. A distribution plot displays amplitude probabilities or the number of level crossings on the vertical axis, against signal amplitude on the horizontal axis. Distributions can be plotted in absolute or normalized units. They can be based on either data from the whole file or zoomed portions of a file.

XY Plots

An XY plot displays the value of one signal on the vertical axis against the value of another one on the horizontal axis. Plots can be based on data from the whole file, or zoomed portions of a file.

Frequency Domain Plots

- Auto and Cross-Spectra
- Transfer Functions
- Coherences

The Durability Alliance

ACCELERATING THE DEVELOPMENT PROCESS

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