RULA

VisAnalyser Software

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VisAnalyser is a powerful program complex intended to record and analyze signals of different dynamic processes. The sources of signals can be different: the data can come from DAQ devices in real-time or from a recorded file.

It is possible to analyze the data acquired with RULA devices or imported from other acquisition systems.

Possible Applications

- Viewing the waveform of the recorded signal;
- Spectrum graphs: calculation of spectrum density, RMS or amplitude spectrum;
- Statistical analysis: calculating RMS, median, minimum and maximum values in the preset fragment of time; calculating the absolute acceleration value on 3 axes; calculating standard deviation;
- Signal integration and double-integration, calculating the absolute value and sigma-clipping;
- Arithmetic operations: adding, dividing or multiplying a signal by a signal or a constant, subtracting a signal from a signal or a constant;
- Filtration with FIR or IIR filters. You can specify the filter type: high-pass, low-pass, band-pass, band-stop, and the frequency parameters (cut-off frequencies and attenuation ratio);
- Shock response spectrum;
- Waterfall analysis;
- Data recording;
- Modal analysis.

Windows Intergation

VisAnalyser can be installed to any Windows OS, starting from Windows 7 or later. To start work, install the program using installation wizard and run the software.

Configurable Software

The software comprises a number of options, which can be flexibly configured to meet the user's requirements.

It is also possible to add more options when you are already working with the program.

RULA
VisAnalyser

Open API

VisAnalyser provides a set of functions, which can be used in third-party software. Thus, you can create your own applications using the algorithms of VisAnalyser software. RULA provides all the necessary documentation and examples for the API.

Data Import and Export

If you want to use an analysis function, which is not implemented in VisAnalyser software, there are two possible solutions:

- export the data into CSV or binary format to view it in Matlab, LabVIEW, etc.;
- implement your own reading program according to open specifications.

Figure 1. Open API integration

Data Analysis

Viewing the Recording File

VisAnalyser enables the user to view files of virtually any length. The whole file or any file fragment can be shown on the graphs. Choose the file fragment in the special preview area, located at the bottom of the graph window, then move the highlighted zone to quickly display a file fragment at any scale.

To see the numbers, which correspond to the graphical data, you can use special cursors – lines, parallel to Y axis. The coordinate of the intersection with X axis and the value of the signal at the intersection point are shown on each of the cursors.

It is also possible to highlight the extreme points on the graphs of any signals.

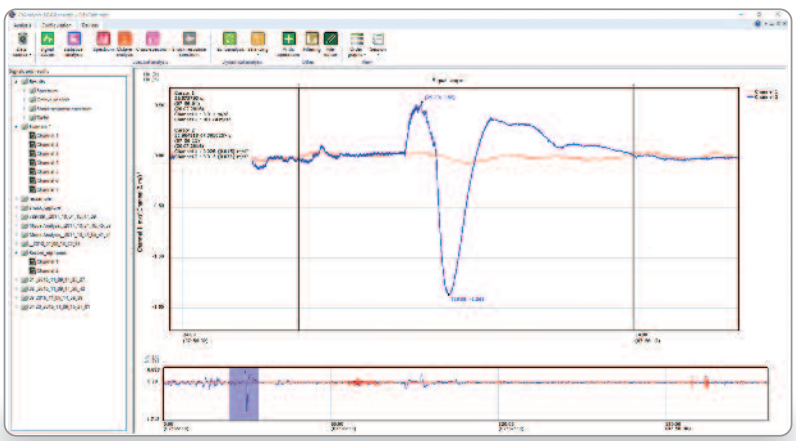


Figure 2. VisAnalyser in the recording viewing mode

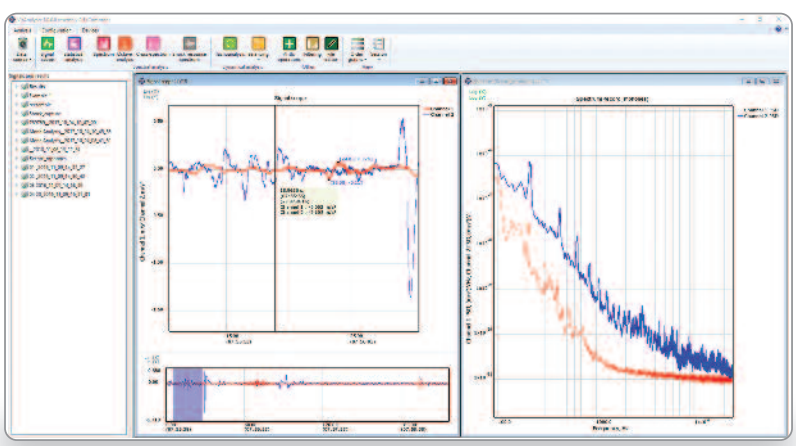


Figure 3. Viewing different files on several graphs

Spectrum Analysis

The user can calculate power spectrum density of the signal, view the RMS and amplitude spectra.

For spectrum analysis, you can specify:

- Window length;
- Window function – Hann, Hemming, Blackman, Newtall, flat-top, Kaiser, Bohmann, Chebyshev;
- Averaging type – linear or exponential;
- Zero offset calculation and subtraction.

Spectrum analysis can be used for vibration diagnostics of machines and mechanisms, finding the source of vibration, finding the differences in the vibration structure of various technical systems.

Part-Octave Analysis

Using part-octave analysis, you can calculate the octave spectrum with the preset octave part from 1/1 to 1/24 based on FFT calculation or IIR-filters.

The results of part-octave analysis can be used for vibration diagnostics of machines and mechanisms, calculating the characteristics of acoustic signal, noise level and vibration level.

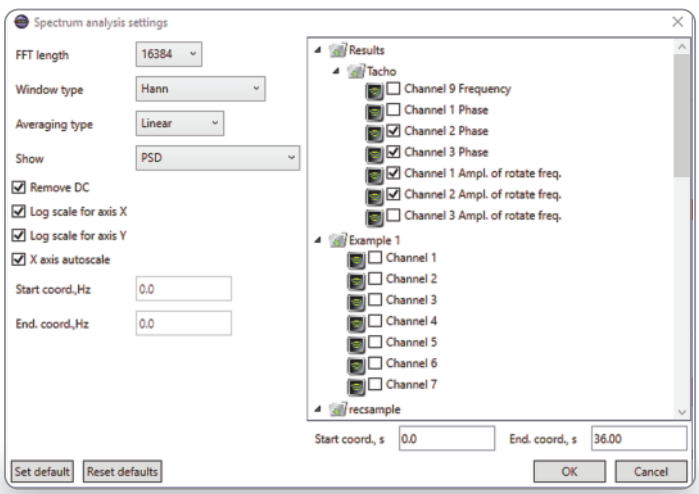


Figure 4. Spectrum analysis settings

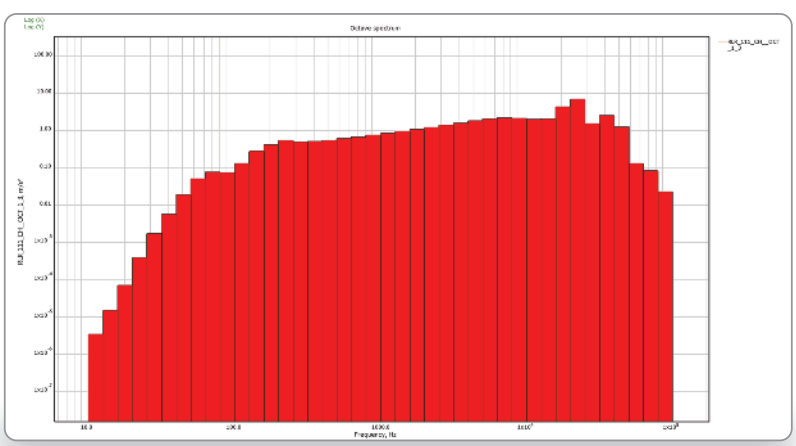


Figure 5. Results of part-octave analysis

Statistical Analysis

Using statistical analysis, you can obtain various integrated characteristics of the signal, in particular:

- RMS;
- Minimum value;
- Maximum value;
- Mean value;
- Median value;
- Sigma-clipping value.

Besides, with statistical analysis the user can perform integration and double-integration of the signal – i.e. analyze the displacement of the object using the recording of acceleration.

Editing Files

In VisAnalyser you can cut the relevant fragment from the data file and then save it as another file for subsequent analysis.

This option is useful when analyzing some particular events within a large data file.

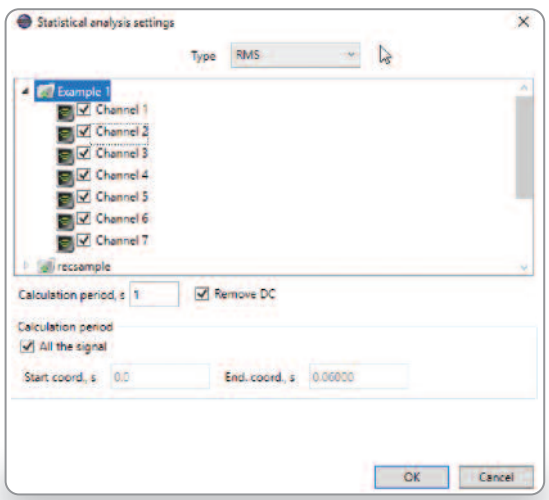


Figure 6. Statistical Analysis Settings

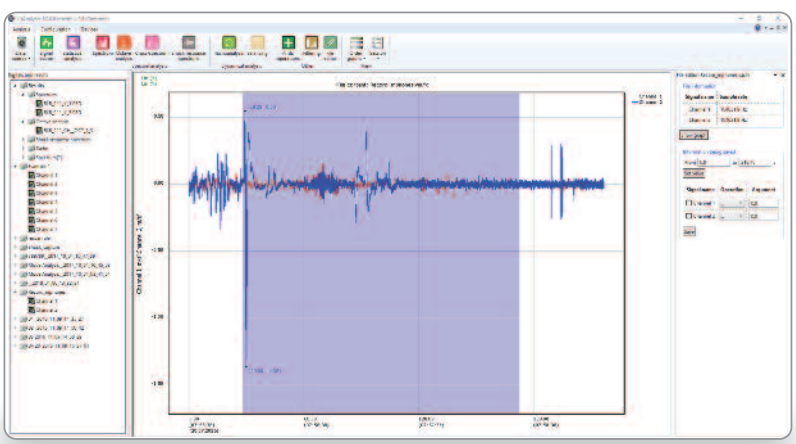


Figure 7. Editing the file

Arithmetic Operations

Besides the statistical analysis, VisAnalyser supports arithmetic operations on the signals.

A signal can be added to a signal or a constant, divided, subtracted or a logarithm can be taken. The arithmetic operations are specified as a line with a formula.

The software supports the most common constants – π, g, e – in the form of symbols, so the user does not have to bother with the number of digits after the decimal point.

The use of patterns helps to automate such operations as data import from the recordings of ADC samples – zero offset is subtracted from the signal and the signal is multiplied by the scaling coefficient in a single operation.

Signal Filtration

Filtering the signals with FIR and IIR filters eliminates the noise component from the signal. The result of filtration, as well as the result of other operations can serve as a source of signal for any type of analysis.

FIR and IIR filters are available. The user can specify the cut-off coefficient and attenuation ratio of the filter.

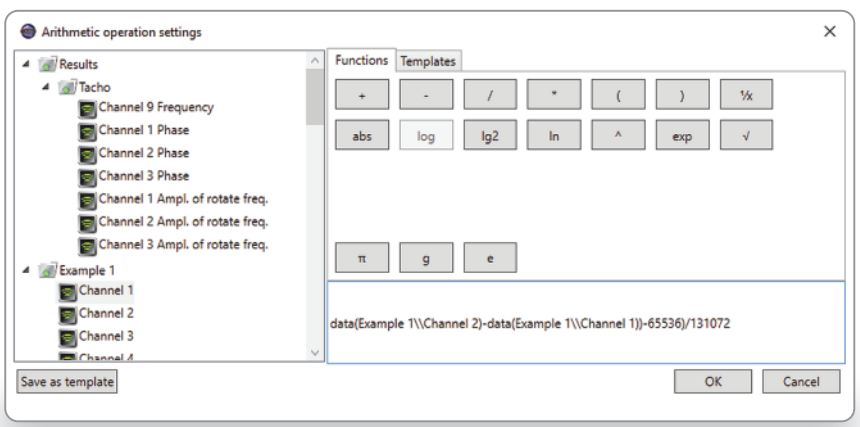


Figure 8. Arithmetic operation set-up

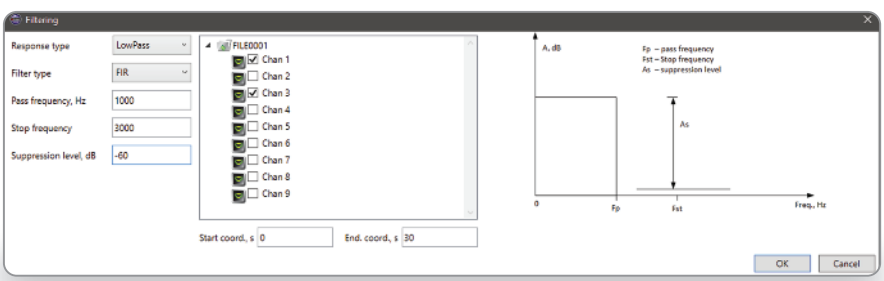


Figure 9. Filtering

SRS Calculation

VisAnalyser is able to calculate shock response spectrum (shock response spectrum is defined as the response to a given acceleration acting at a set of mass-damper-spring oscillators, which are adjusted to the different resonance frequencies while their resonance gains (Q-factor) are equal) based on the file with data.

This type of analysis has the following settings:

- Frequency range;
- Damping factor and Q-factor;
- Wavelet frequency setting - linear or logarithmic;
- Frequency step.

The results of this analysis can be used to compare and identify shock impacts and in seismic analysis.

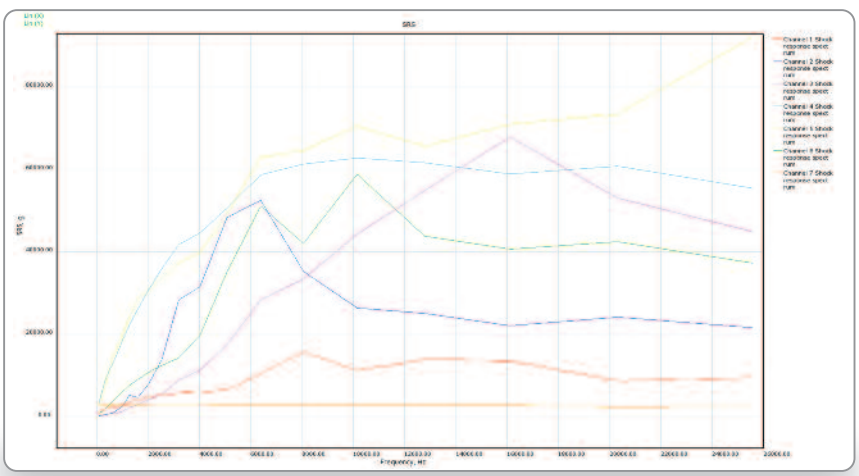


Figure 10. An example of a SRS graph

Additional Options

Besides the most common types of analysis, VisAnalyser supports a number of highly specialized operations used for various types of balancing and data analysis from tacho-sensors.

Tacho-Analysis

With this type of analysis, the user can see the following parameters:

- rotation frequencies;
- phases of signals from accelerometers referenced to the signal from the tacho-sensor;
- imbalance vector.

The results of tacho-analysis can be imported to the balancing calculator and balancing wizard.

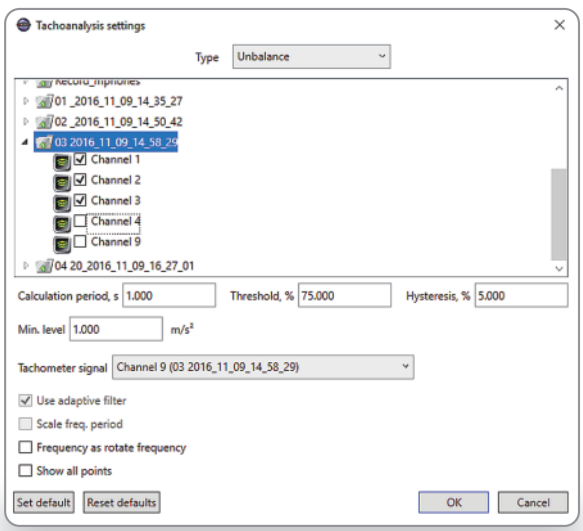


Figure 11. Imbalance calculation settings

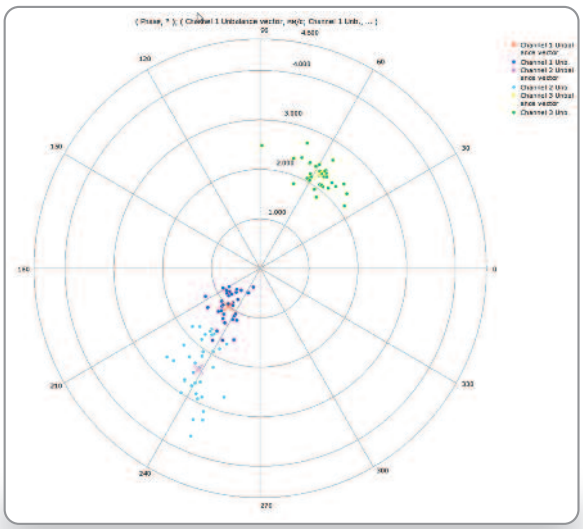


Figure 12. The result of imbalance calculation

Balancing Calculator

VisAnalyser has an embedded balancing calculator for vibration diagnostics, which helps to calculate the value and position of the corrective weight.

The calculator supports both setting and removing the corrective weight.

Balancing Wizard

A fully functional balancing wizard, which supports one-plane balancing and accepts files of recorded data and values as raw data, makes VisAnalyzer a perfect tool of vibration diagnostics.

The balancing wizards takes the user through all the steps of the balancing procedure – from choosing the object and balancing method to generating a report, which can include imbalance graphs with the heavy point and weight positioning.

Besides the trial run method, the balancing wizard provides an opportunity to use dynamic influence coefficients to balance the equipment in one run. This method considerably simplifies the balancing procedure. In addition, dynamic influence coefficients allow the user to assess the dynamic efforts in the bases of the rotors, using the parameters of vibration as raw data. This function is useful when you have already balanced this rotor before.

In case it is not possible to position the weight in the light point, the balancing wizard splits the weight in two parts, which can be fixed in the locations that are more convenient.

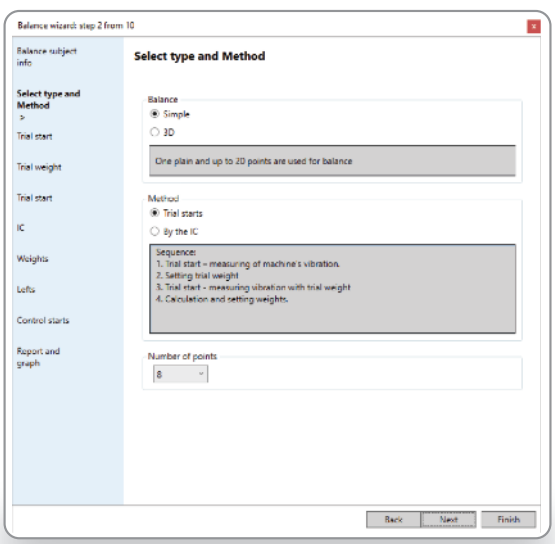


Figure 13. Method and balancing type set-up

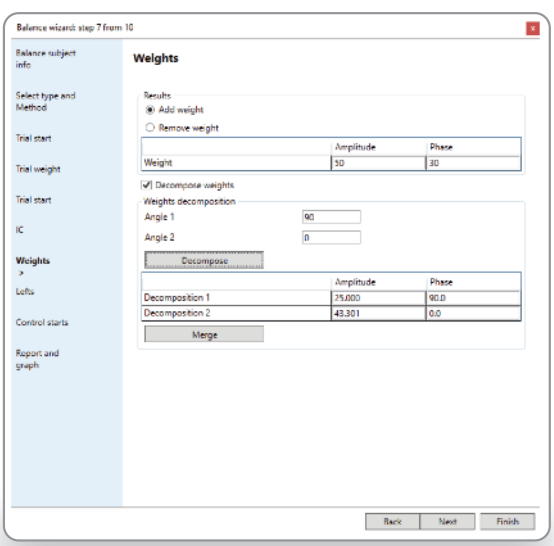


Figure 14. Splitting Weights

Online Analysis

Online analysis is the analysis of the data acquired from the analog channels of the acquisition systems in real time. It is possible to analyze data from up to 512 channels from different sources. The following types of analysis are available in this mode:

- Spectrum analysis;
- Part-octave analysis;
- Statistical analysis;
- FIR and IIR filters;
- Waterwall analysis.

VisAnalyser can work with configurations of several devices. For example, you can create a DAQ system with either 8 RL-R19 or 8 RL-C21 devices.

Data Recording

Online analysis mode has an option of data recording. The maximum duration of the recording is only limited by the PC hard drive capacity. With this option, the user can run empirical tests and then analyze the acquired data using all the tools of VisAnalyser mathematical package.

Complex Analysis

Similarly to the data analysis mode, the analysis results in the online mode can serve as an input signal for other types of analysis, for example, RMS or spectrum calculation.

VisAnalyser can display the information in the text format – a useful option for controlling the main test parameters. For example, for all the results of statistical analysis the program displays a special panel, which shows the value of the signal in real time in a large font.

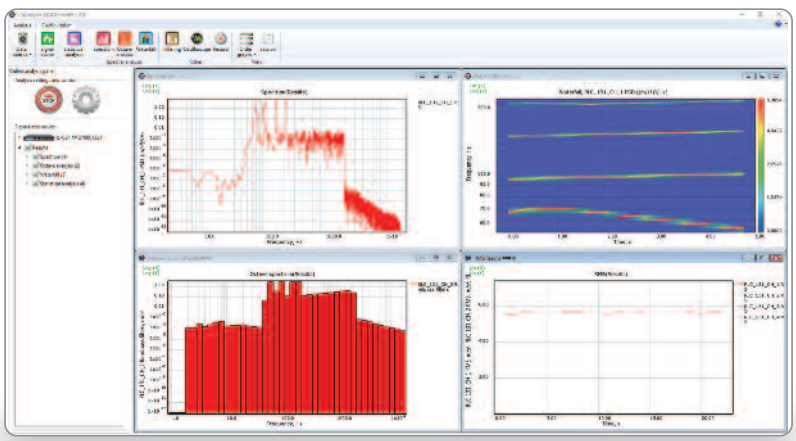


Figure 15. VisAnalyser in the online analysis mode

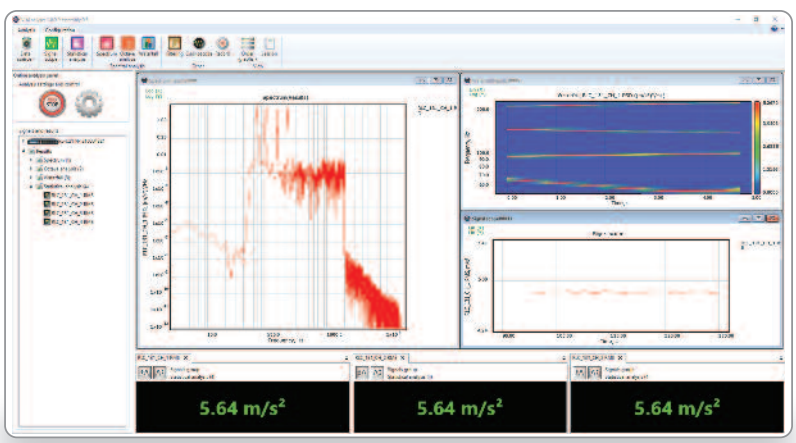


Figure 16. VisAnalyser in the online analysis mode

Waterfall Analysis

Waterfall analysis shows the dependency of the signal from frequency and time simultaneously. This type of analysis is used to study the spectrum structure of the signal in time.

This type of analysis is a unique tool for finding resonant frequencies of machines and mechanisms: changes in the vibration level are clearly seen on such graphs. Waterfall analysis is also useful to test rotating parts in the speeding up and slowing down modes.

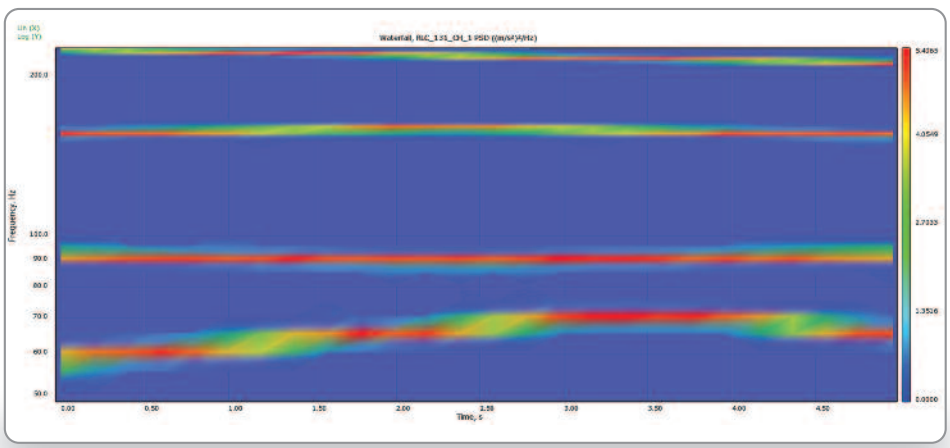


Figure 17. An example of a waterfall graph

Modal Analysis

Modal analysis is essential for finding resonant frequencies and waveforms of the object under test.

The software calculates the magnitude and phase frequency response to obtain resonant frequencies and waveforms, analyzing the reaction of the object under test to some impact. This impact can be different – a shock, a sine wave, random vibration, etc.

Methods of amplitude and phase parameters calculation - H_1, H_2, H_V.

Similarly to other analysis types, modal analysis can use recorded data or the data received in real time from analog channels of the devices.

In the first case the recordings from analog and digital channels are entered, and then FRF is calculated.

In real time VisAnalyser can run discrete modal analysis – for example using a shock hammer - as well as continuous modal analysis.

3D-constructor helps to build a prototype of the system under test to further visualize the deflection shapes.

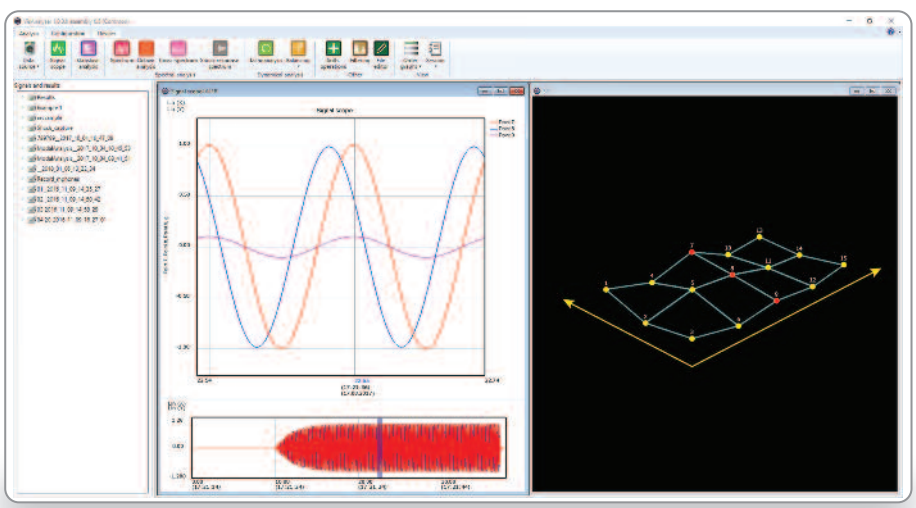
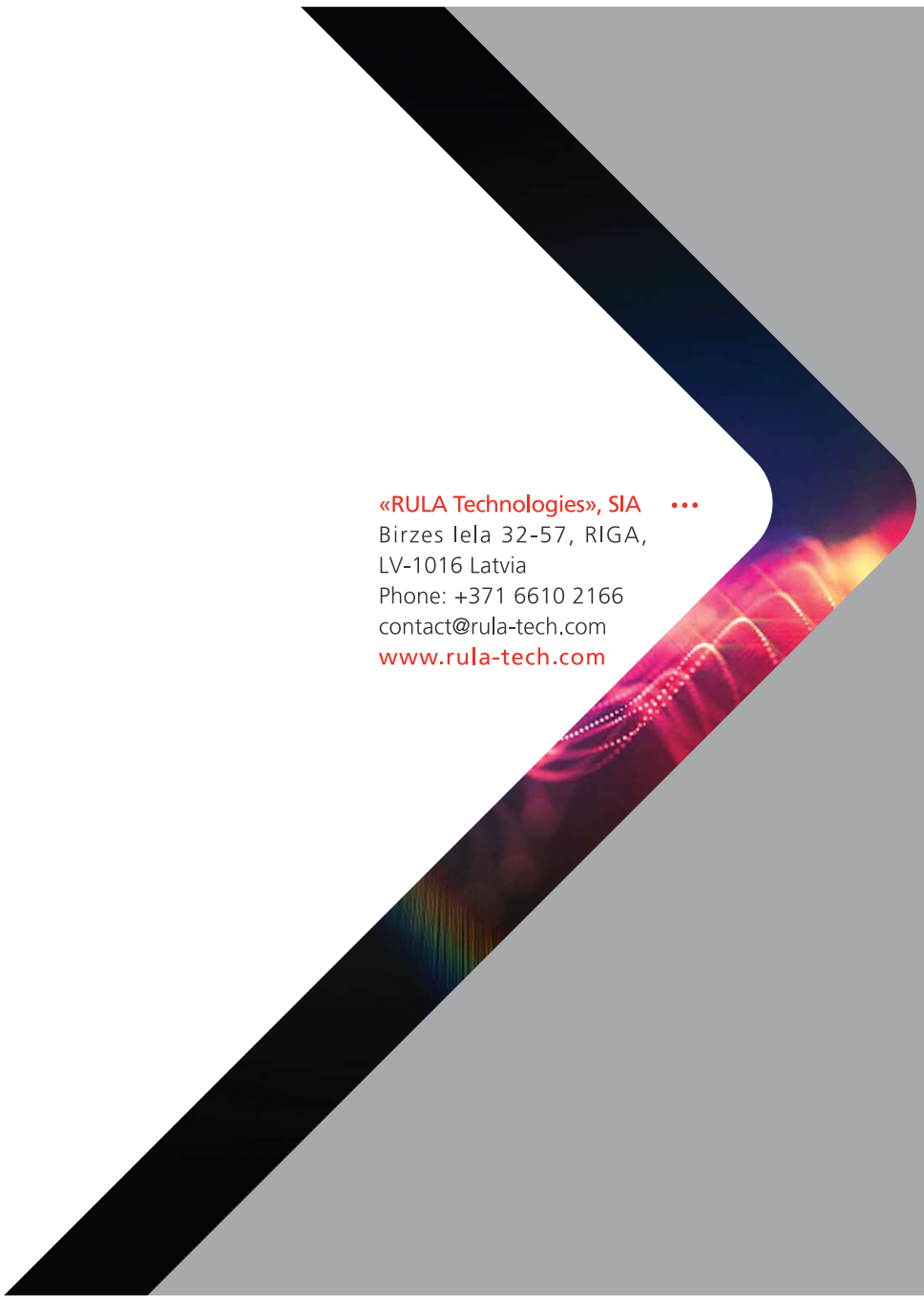


Figure 18. Modal analysis



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