

# manual chart wizard

# 8

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impact  
design  
europe

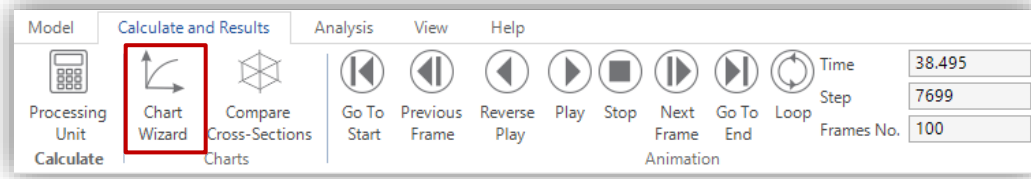


*The fastest way in Pre Design*

|  |           |
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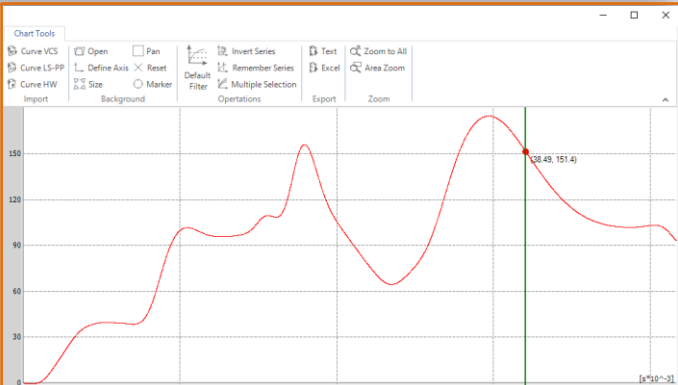
Chart Wizard is used to create various results graphs.

The icon "Chart Wizard" is located on the main toolbar of the "Calculate and Results" section



After selecting the Chart Wizard icon a separate window will be visible on the screen:

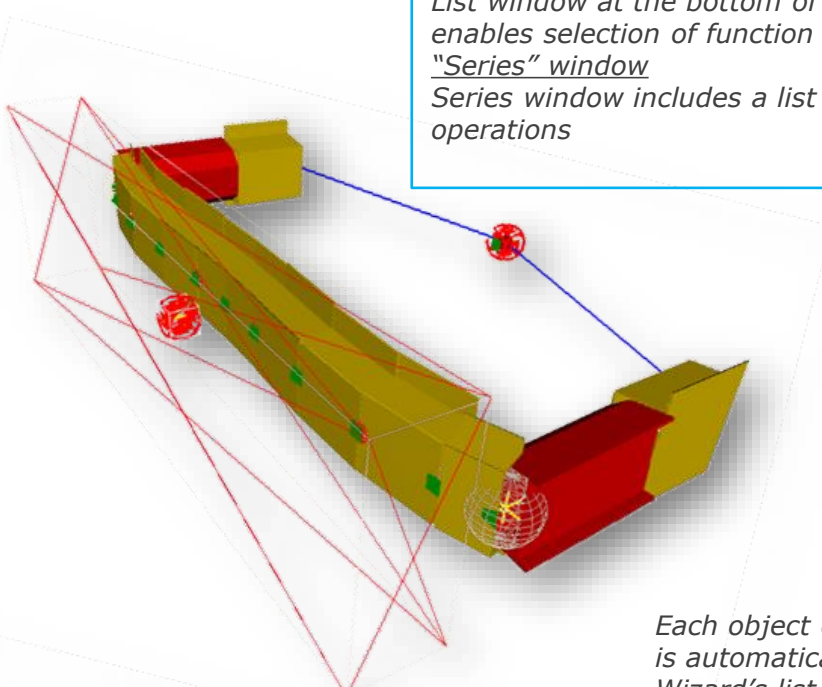
*Selection window for dependent variable (ordinate). The default independent variable (X axis) is time.*



*The main window presents the function chart. Green time marker line illustrates the moment of the load case simulation.*

"Domain" window  
List window at the bottom of Chart Wizard enables selection of function domain.

"Series" window  
Series window includes a list of available curve operations

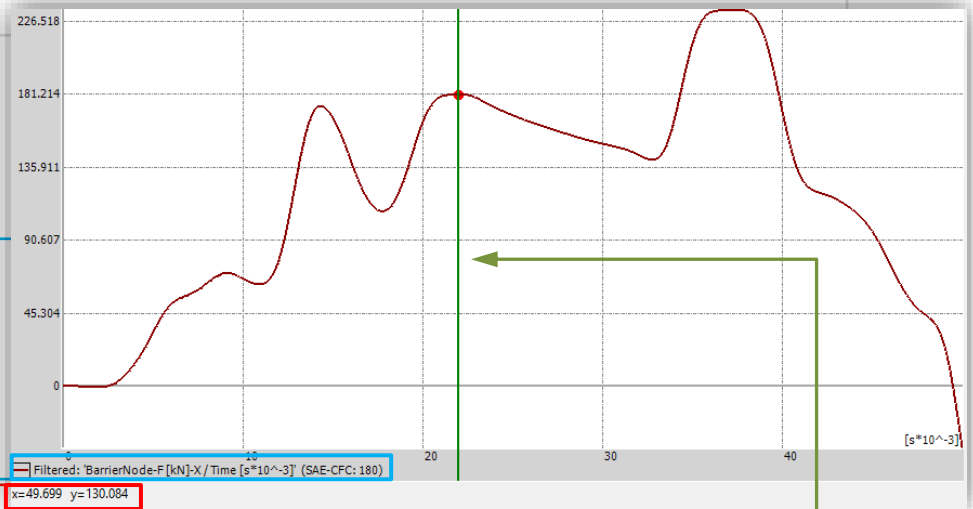


Each object of a VCS model selected in the 3D view is automatically added to the list in the Chart Wizard's list window on the left-hand side.

## FUNCTION WINDOW

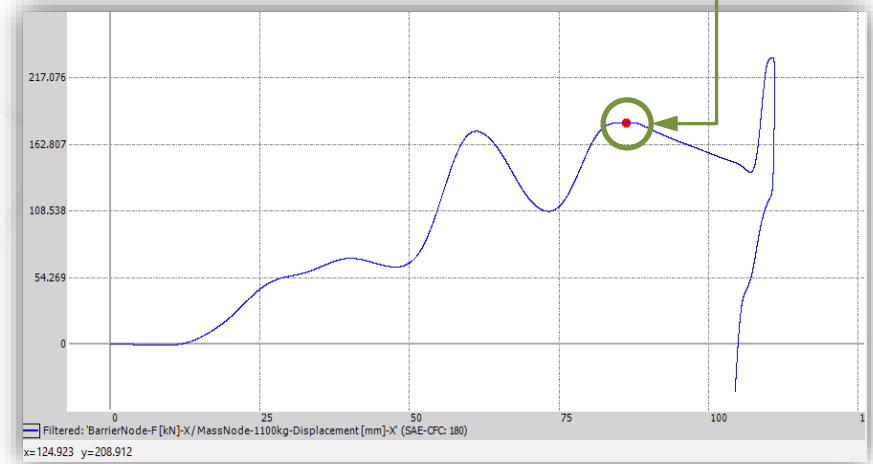
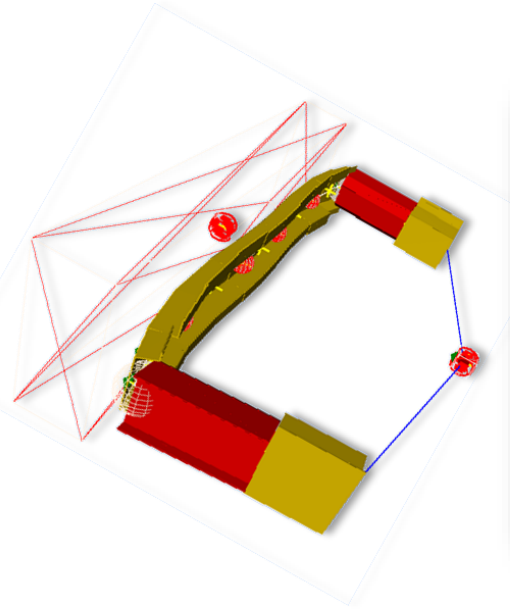
The main window of the Chart Wizard presents the function chart. Please note that the default independent variable (X-axis) is time.

All displayed results are listed below the chart. For each curve the name and line color is presented.



Exact coordinates of the current cursor position are shown on the bottom of the function window.

**Time marker**



Time marker illustrates the moment of the load case simulation.

In case when the independent variable is time a green time marker line is displayed in the chart window. Additionally, a red dot can be seen on the curve.

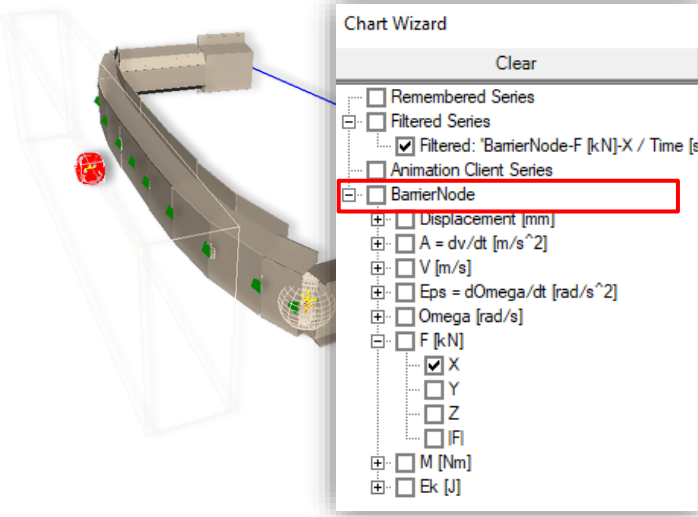
Whenever the VCS animation is activated, the line and the dot will move accordingly to the simulation process.

In case then the function domain is set differently (X axis is not set to time) only the red dot time marker is displayed in the chart window. Whenever the VCS animation is activated the red dot will move along the result curve accordingly to the simulation time.

In the example presented above the Y axis is set to force (barrier node), the X axis is set to displacement (rear mass node of the structure).

## SELECTION WINDOW

For VCS results the user can select any object of the Solution.



Any object selected in the VCS 3D view or in the Explorer window will be added to the list on the left side of Chart Wizard.

After expanding the object's folder, you will be able to see a complete list of results available for this specific object. In the example presented on the left available results for a node object are presented.

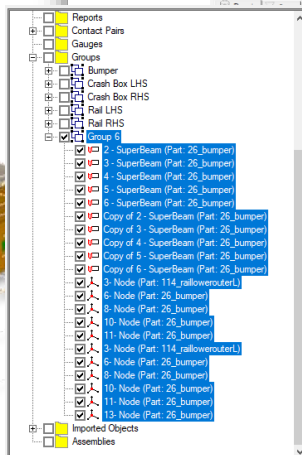
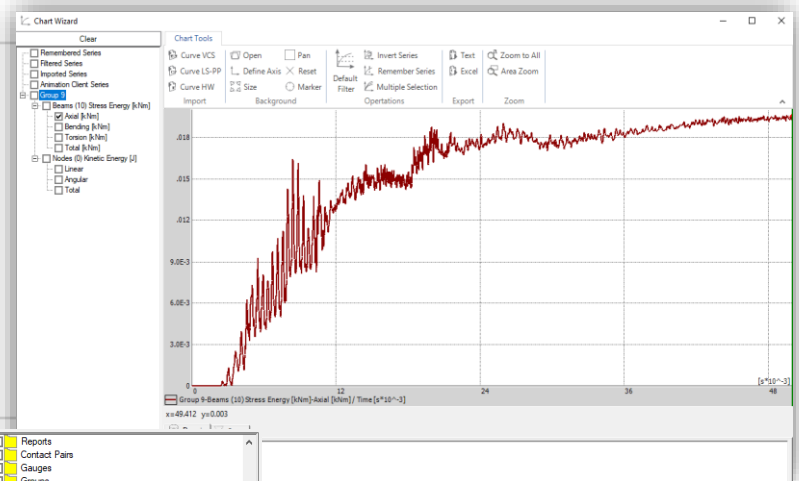
It is also possible to view results for a group of VCS objects.

After creating a group of objects in the 3D view you can select this group from the Solution Explorer tree.

In the Chart Wizard you will be able to view results for Beams and Nodes of the selected Group.

In case of Beam elements contained within the selected Group it is possible to view results for:

- Beams Stress Energy [kNm]
- Axial
- Bending
- Torsion
- Total



In case of Node elements contained within the selected Group it is possible to view results for:

- Nodes Kinematic Energy [J]
- Linear
- Angular
- Total

Similarly, it is possible to view results for the entire **VCS Solution**.

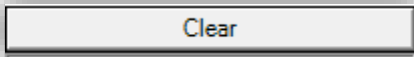
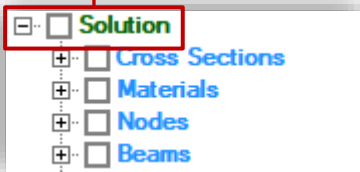
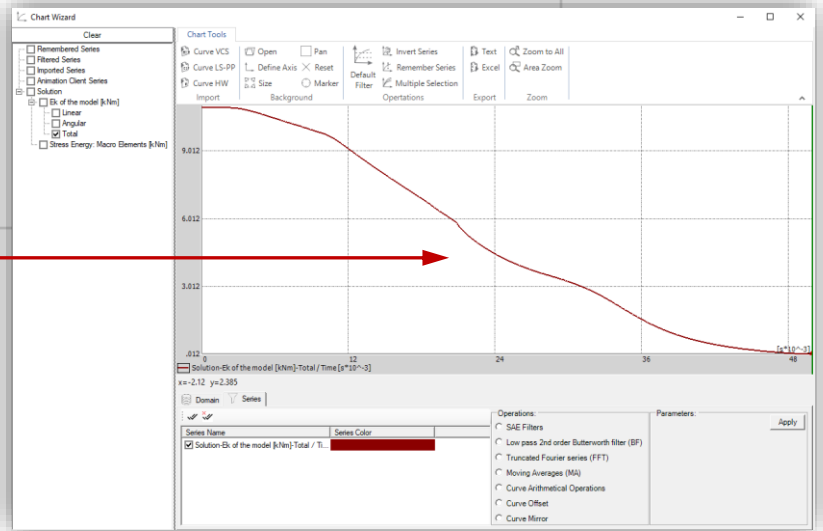
After selecting the 'Solution' in the Solution Explorer window you will be able to view the Solution's results for:

Ek of the model [kNm]

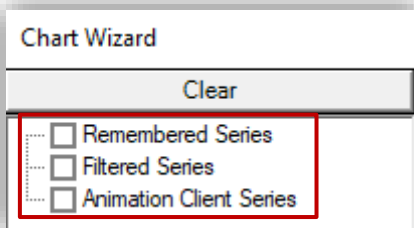
- Linear
- Angular
- Total

Stress Energy:

Macro Elements [kNm]



Click the "Clear" button above the list window in order to clear all previous selections made in the VCS 3D view.



In the list window three default folders can be always found:

Remembered series:

Here all remembered curves can be found.

All results added to the "Remembered Series" folder by means of the "Remember Series" tool will be accessible whenever the Chart Wizard window is opened until the user closes the VCS file.

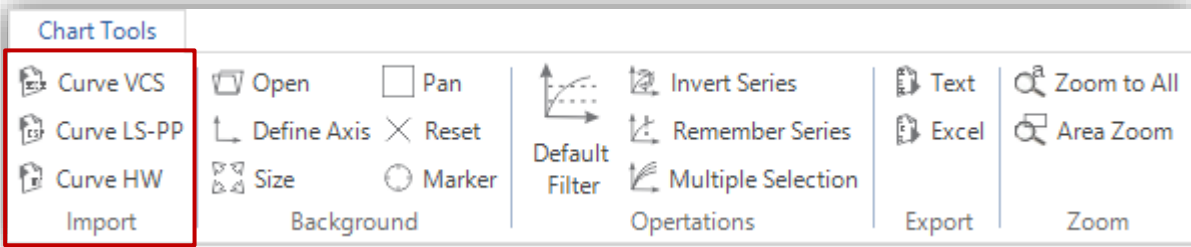
Filtered series:

All curves created as a result of a filtering operation can be found in the "Filtered Series" folder.

Animation Client Series:

Adequate curves of all synchronized VCS files (added by means of the Synchronization functionality) can be found in the "Animation Client Series" folder

## CHART WIZARD MAIN TOOLBAR

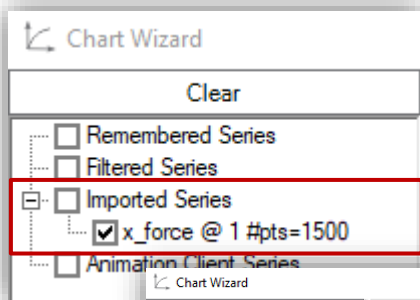


### Chart Wizard IMPORT POSSIBILITIES

In the "import" section of the toolbar the user can find three curve import possibilities:

- Import VCS Curve – result curve previously exported in text file format (see: Chart Wizard EXPORT possibilities)
- Import LS-PP Curve
- Import HW Curve

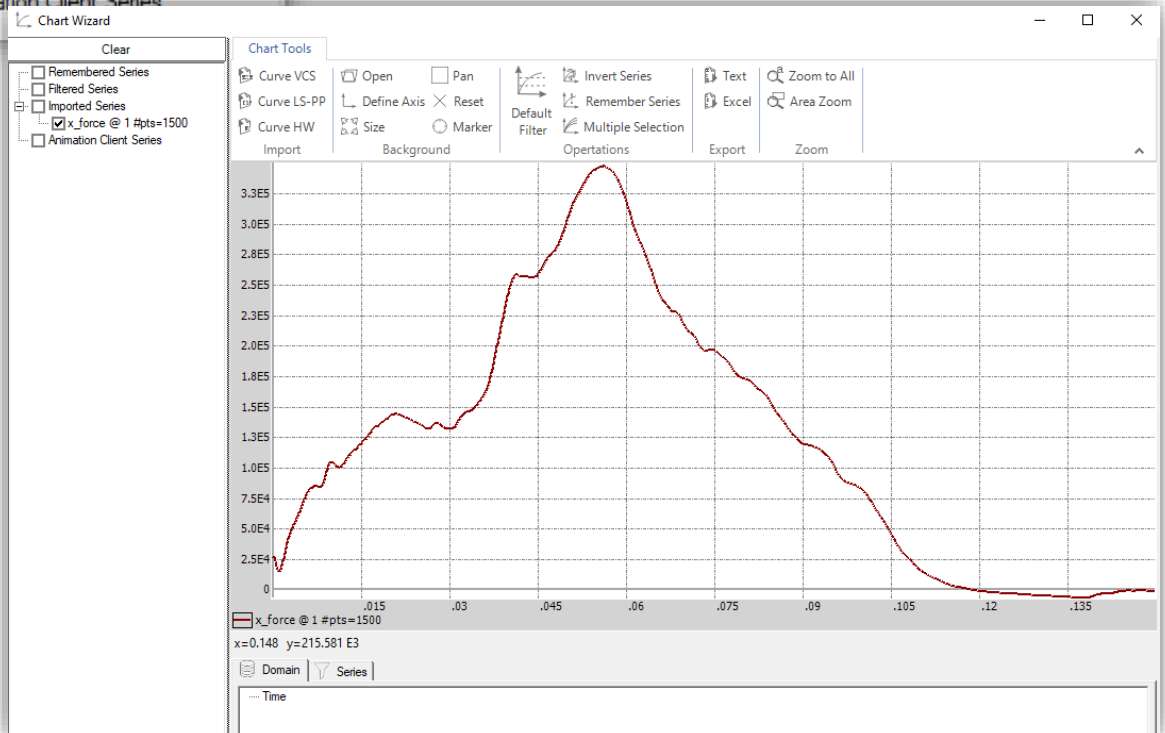
In order to import a result curve into Chart Wizard simply click on a required icon and open a previously exported and saved result.



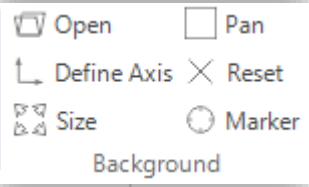
Imported curve will be automatically displayed in the chart Wizard's function window.

All imported curves are catalogued in the "Imported series" folder.

In order to delete an imported result right-click on its name and press "Delete"



## CHART WIZARD MAIN TOOLBAR – BACKGROUND TOOLS



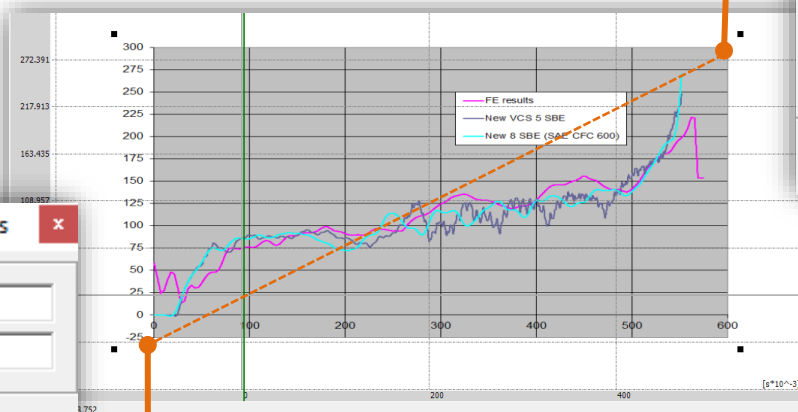
### Chart Wizard BACKGROUND TOOLS

In the Chart Wizard window you will find tools which will enable you to modify the chart's view.

**Open** – with the usage of this tool you can load an image into the chart window. This function allows easy comparison between simulation results and data collected in the past and imported as a picture.

**Pan** – tool for translation of a loaded picture

**Define Axis** – changes a chart scale



**Start Point Coordinates** [X]

Coordinates :

X:

Y:

**End Point Coordinates** [X]

Coordinates :

X:

Y:

The "Define Axis" tool can be used to scale an imported background to enable proper comparison of results.

Click in a chosen location of the function window and enter required coordinates. Afterwards click in the second location in the function window and repeat the procedure.

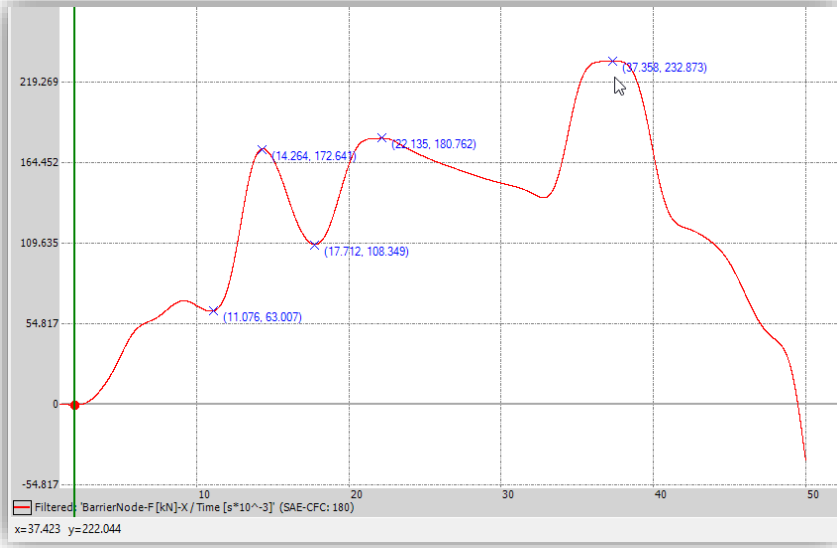
The imported background picture will be scaled accordingly to the defined axis.

**Reset Background** – Resets background back to default settings. Any added background will be deleted from view

**Size Background** – enables matching an imported chart to required scale.



**Marker** – see exact coordinates of selected point on the chart

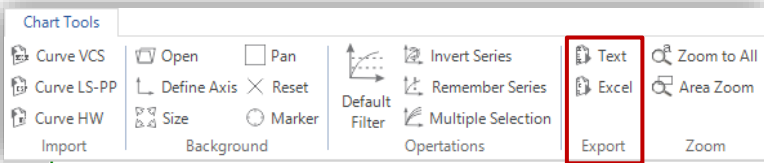


After selecting the "Marker" tool whenever you click in the function window the exact coordinates of the cursor's location will be displayed.

This functionality enables quick access to precise result values (from the requested region of the curve).

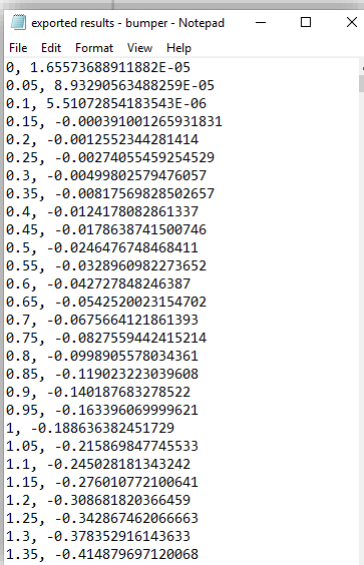
Right click in the function window in order to delete all marked locations

## CHART WIZARD MAIN TOOLBAR – EXPORT TOOLS



**Export Text** – export selected series in text file format

Export tool enables saving chart data as a text file. The operation is helpful for external post processing purposes.

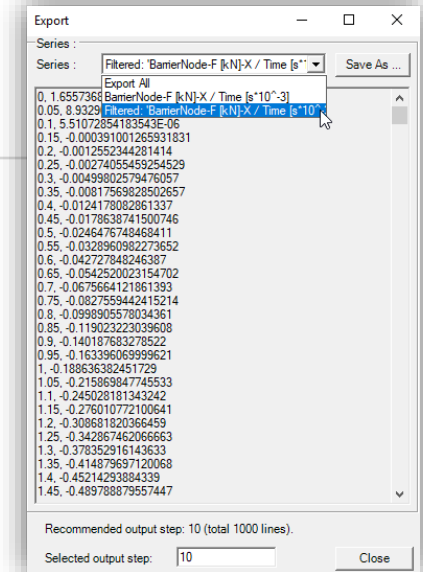


After selecting the "Export" icon in the main toolbar a new "Export" window will be displayed on the screen.

In this window the user can select the series for export.

Afterwards the selected results can be saved.

Additionally, the user has the possibility to define the output step (at the bottom of the "Export" window). By default, it is set to the recommended value.



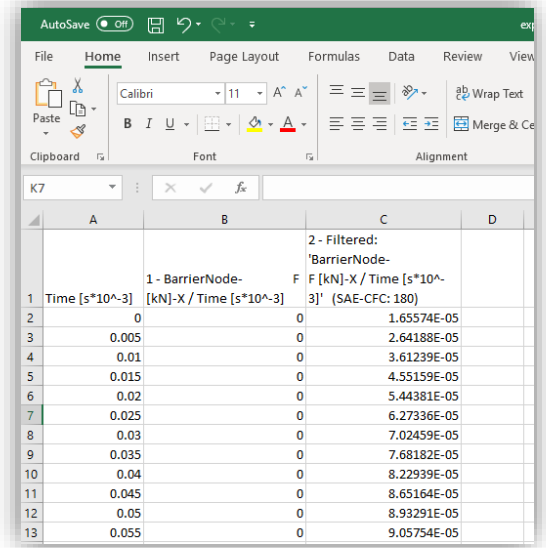
 **Export to Excel** – export selected series in text file format

Similarly, any curve of the Chart Wizard can be saved as an Excel file.

After selecting the "Export to Excel" icon in the main toolbar a new "Export" window will be displayed on the screen.

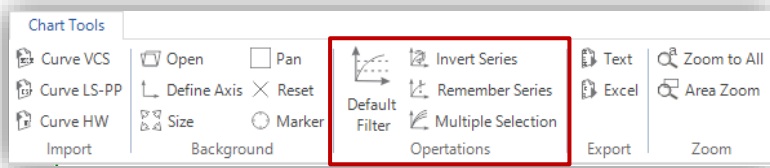
In this window the user can select the series for export.

Afterwards the selected results can be saved and later opened in the Excel software (as presented in the picture on the right).



|    | A                          | B  | C  | D |
|----|----------------------------|--|--|---|
| 1  | Time [s*10 <sup>-3</sup> ] | 1 - BarrierNode- [kN]-X / Time [s*10 <sup>-3</sup> ] | 2 - Filtered: BarrierNode- F [kN]-X / Time [s*10 <sup>-3</sup> ]' (SAE-CFC: 180) |   |
| 2  | 0                          | 0  | 1.65574E-05  |   |
| 3  | 0.005                      | 0  | 2.64188E-05  |   |
| 4  | 0.01                       | 0  | 3.61239E-05  |   |
| 5  | 0.015                      | 0  | 4.55159E-05  |   |
| 6  | 0.02                       | 0  | 5.44381E-05  |   |
| 7  | 0.025                      | 0  | 6.27336E-05  |   |
| 8  | 0.03                       | 0  | 7.02459E-05  |   |
| 9  | 0.035                      | 0  | 7.68182E-05  |   |
| 10 | 0.04                       | 0  | 8.22939E-05  |   |
| 11 | 0.045                      | 0  | 8.65164E-05  |   |
| 12 | 0.05                       | 0  | 8.93291E-05  |   |
| 13 | 0.055                      | 0  | 9.05754E-05  |   |

## CHART WIZARD MAIN TOOLBAR – OPERATIONS



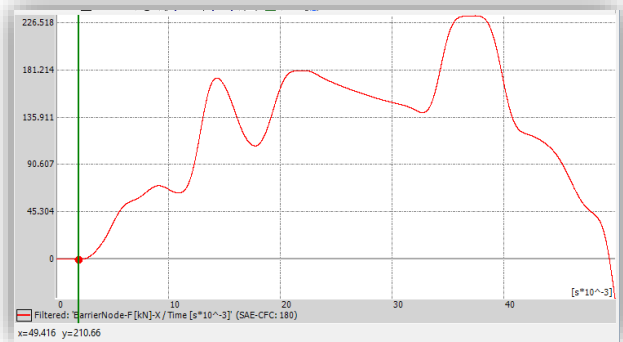
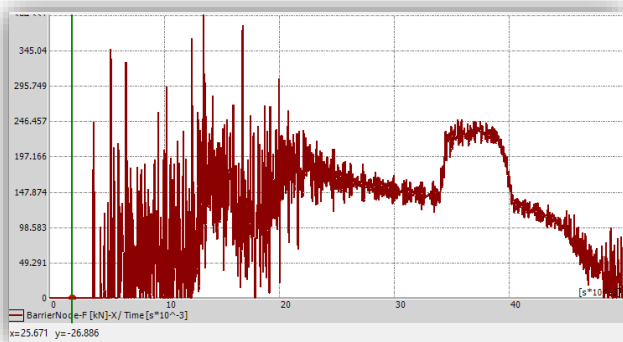
Default Filter **Default filter**

**Default Filter** button converts current curve to its filtered counterpart.

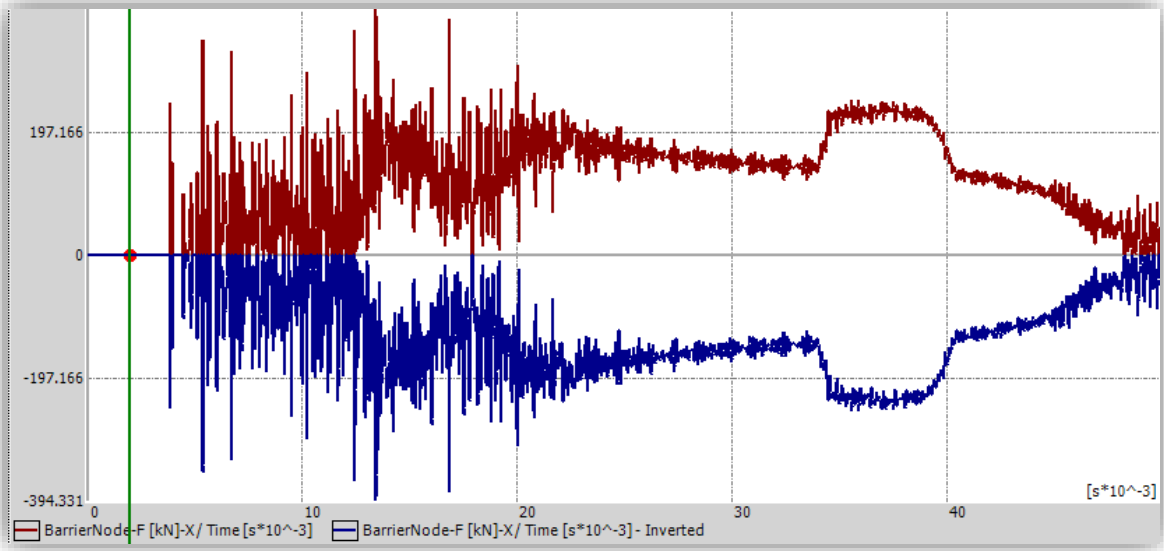
Initially the default filter is set to the 180 channel class.

Application of another filter switches automatically **Default Filter** to the last chosen one.

In the pictures on the left you can see raw chart data and filtered respectively.



## **Invert Series**



***Invert Last Series*** tool inverts the last selected curve.

The tool automatically creates a curve mirrored with respect to the X axis. In other words, all values of the ordinate (Y axis) are multiplied by the parameter [-1]

Please note that in the Chart Wizard's main view you can find both the initial results and results affected by the curve operation routine

## **Remember Series**

Any result curve created in the Chart Wizard can be saved after clicking on the "Remember Series" tool.

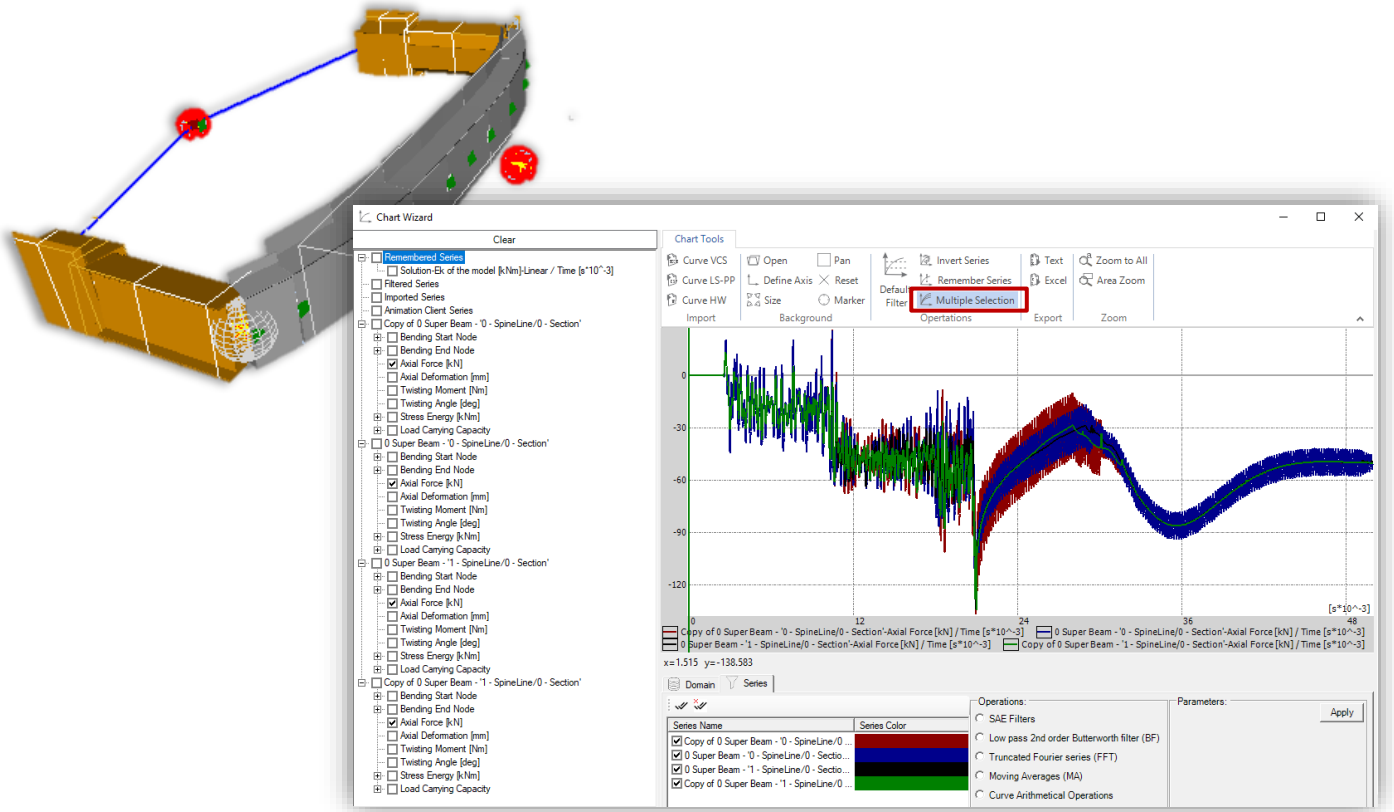
The selected series will be added to the "Remembered Series" folder.

All results added to the "Remembered Series" folder by means of the "Remember Series" tool will be accessible whenever the Chart Wizard window is opened until the user closes the VCS file.

Right click on a remembered series in order to rename it or deleted it from Chart Wizard.

## Multiple Selection

The 'Multiple Selection' tool selects a chosen series of results automatically in all objects selected from the Solution.

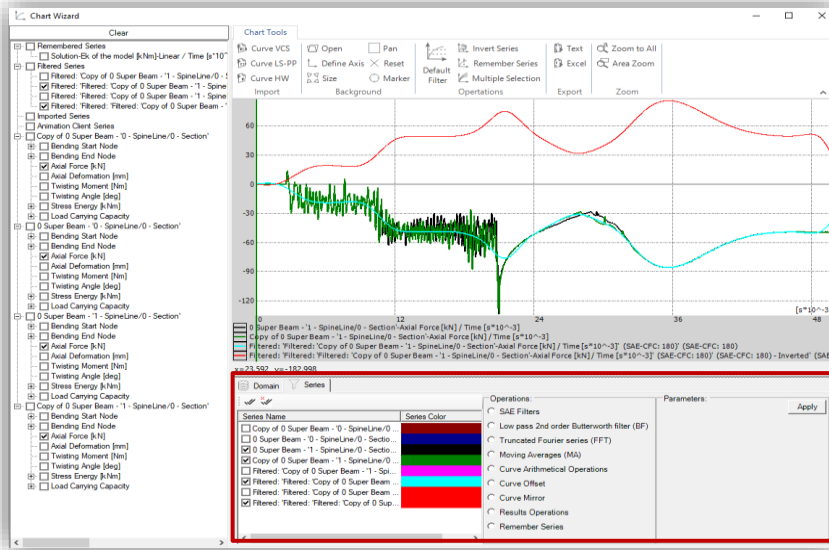


In the example shown above, after clicking on the 'Multiple Selection' tool the 'Axial Force' series of results was selected for an object (Super beam). Automatically 'Axial Force' series were marked for all objects in the Chart Wizard, and their results could be seen in the chart window.

This tool provides the possibility of easy and quick comparison of results of a number selected elements of the Solution.



## CHART WIZARD – SERIES WINDOW



In the Series window the user can find all series available for display in the currently opened Chart Wizard.

In order to show or hide a series click on its check box on the left side.

All curves created as a result of filtering procedure or curve operation will be automatically added to the series list.

Double click on a selected series name in order to change the displayed curve color.

The screenshot shows the 'Series' window in Chart Wizard. The 'Series' tab is selected, showing a list of series names and their corresponding colors. The 'Operations' section is also visible, with 'SAE Filters' selected. The 'Parameters' section is also visible, with 'Channel Frequency Class (CFC)' selected and an 'Apply' button.

| Series Name   | Series Color |
|---|--------------|
| <input type="checkbox"/> Copy of 0 Super Beam - '0 - SpineLine/0 - Section' Axial Force [N]   | Red          |
| <input type="checkbox"/> 0 Super Beam - '0 - SpineLine/0 - Section' Axial Force [N]   | Blue         |
| <input checked="" type="checkbox"/> 0 Super Beam - '1 - SpineLine/0 - Section' Axial Force [N]  | Green        |
| <input checked="" type="checkbox"/> Filtered: 'Filtered: 'Copy of 0 Super Beam - '1 - SpineLine/0 - Section' Axial Force [N]            | Cyan         |
| <input checked="" type="checkbox"/> Filtered: 'Filtered: 'Copy of 0 Super Beam - '1 - SpineLine/0 - Section' Axial Force [N]            | Magenta      |
| <input checked="" type="checkbox"/> Filtered: 'Filtered: 'Filtered: 'Copy of 0 Super Beam - '1 - SpineLine/0 - Section' Axial Force [N] | Red          |

In the "Series" window all available filtering possibilities and curve operations can be found and selected.

The screenshot shows the 'Operations' section in the 'Series' window. The 'SAE Filters' option is selected. Other options include 'Low pass 2nd order Butterworth filter (BF)', 'Truncated Fourier series (FFT)', 'Moving Averages (MA)', 'Curve Arithmetical Operations', 'Curve Offset', 'Curve Mirror', and 'Results Operations'.

After selecting a requested operation or filter additional appropriate settings can be made in the "Parameters" window.

When all parameters are properly defined click on the "Apply" icon to finish the procedure



In Chart Wizard number of filters designed for converting the diagram curve are available.

## SAE Filters

Select the requested channel frequency class (CFC)

|  |  |
|--|--|
| <b>Operations:</b><br><input checked="" type="radio"/> SAE Filters<br><input type="radio"/> Low pass 2nd order Butterworth filter (BF)<br><input type="radio"/> Truncated Fourier series (FFT)<br><input type="radio"/> Moving Averages (MA)<br><input type="radio"/> Curve Arithmetical Operations<br><input type="radio"/> Curve Offset<br><input type="radio"/> Curve Mirror<br><input type="radio"/> Results Operations<br><input type="radio"/> Remember Series | <b>Parameters:</b><br>Channel Frequency Class (CFC) <input type="button" value="Apply"/><br><input type="radio"/> CFC 60<br><input type="radio"/> CFC 180<br><input type="radio"/> CFC 600<br><input type="radio"/> CFC 1000 |
|--|--|

|  |   |
|--|---|
| <b>Operations:</b><br><input type="radio"/> SAE Filters<br><input checked="" type="radio"/> Low pass 2nd order Butterworth filter (BF)<br><input type="radio"/> Truncated Fourier series (FFT)<br><input type="radio"/> Moving Averages (MA) | <b>Parameters:</b><br>Low pass 2nd order Butterworth filter (BF)<br>Cut off frequency [Hz]: <input type="text"/><br>Sampling frequency [s]: <input type="text" value="5E-06"/> <input type="button" value="Apply"/> |
|--|---|

## Low pass 2<sup>nd</sup> order Butterworth filter

Define the cut off frequency [Hz] parameter and the sampling frequency [s]

|  |  |
|--|--|
| <b>Operations:</b><br><input type="radio"/> SAE Filters<br><input type="radio"/> Low pass 2nd order Butterworth filter (BF)<br><input checked="" type="radio"/> Truncated Fourier series (FFT)<br><input type="radio"/> Moving Averages (MA)<br><input type="radio"/> Curve Arithmetical Operations<br><input type="radio"/> Curve Offset<br><input type="radio"/> Curve Mirror<br><input type="radio"/> Results Operations<br><input type="radio"/> Remember Series | <b>Parameters:</b><br>Truncated Fourier series (FFT) <input type="button" value="Apply"/><br>Cut off frequency [Hz]: <input type="text"/><br>Retain peak value: <input type="checkbox"/><br>Width of peak control range as a percentage of elapse time [%]: <input type="text" value="2"/> |
|--|--|

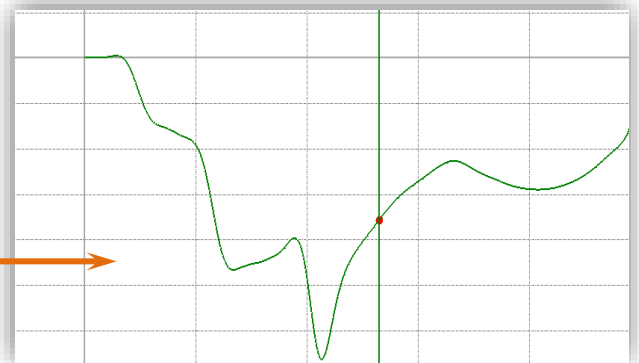
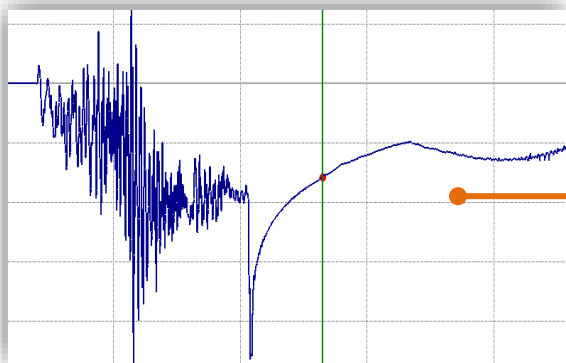
## Truncated Fourier series (FFT)

Define the cut off frequency [Hz] parameter. If needed select the retain peak value. Finally set the width of peak control range as a percentage of elapse time [%]

|  |  |
|--|--|
| <b>Operations:</b><br><input type="radio"/> SAE Filters<br><input type="radio"/> Low pass 2nd order Butterworth filter (BF)<br><input type="radio"/> Truncated Fourier series (FFT)<br><input checked="" type="radio"/> Moving Averages (MA) | <b>Parameters:</b><br>Moving averages (MA) <input type="button" value="Apply"/><br>Range (int): <input type="text"/> |
|--|--|

## Moving Averages (MA)

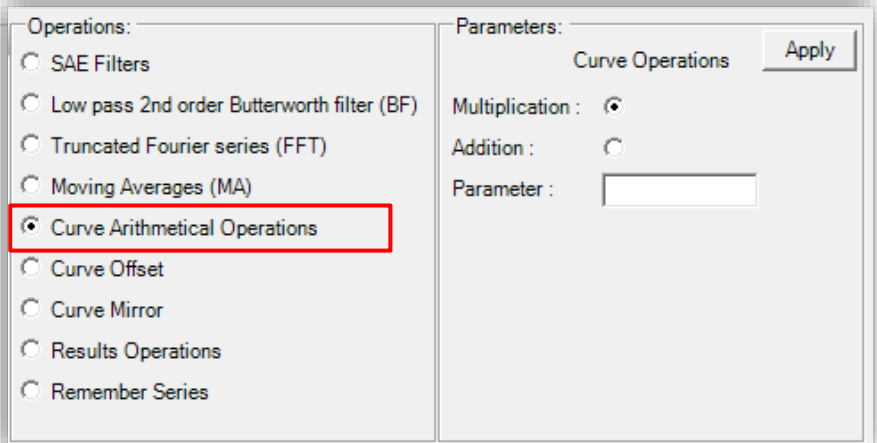
Define the range value



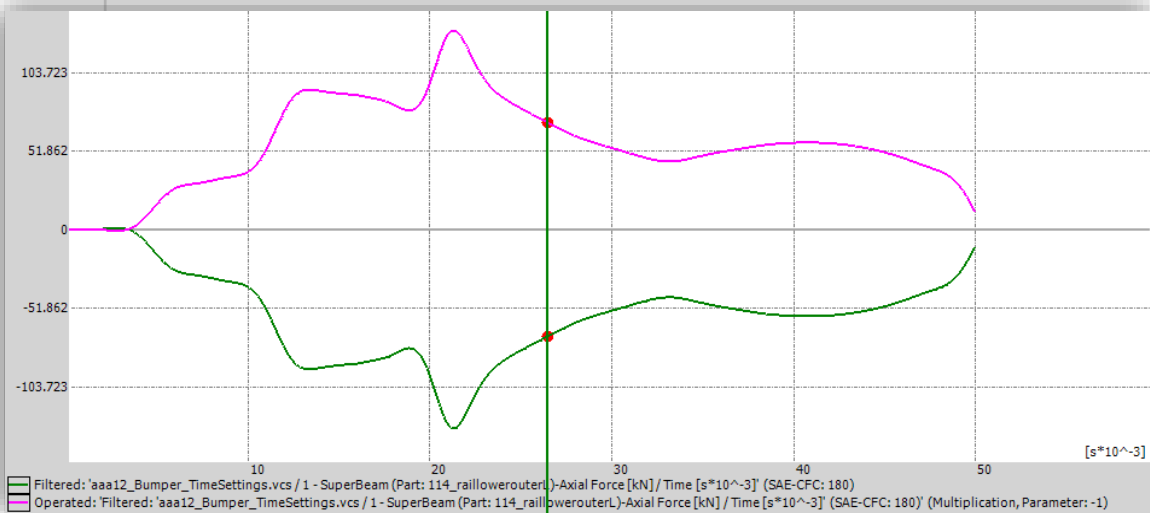
The Curve Operation option enables the User to multiply received results by a given number or to add a user defined parameter.

In order to use the "Curve Arithmetical Operations" check this option in the "Operations" field of the Series window.

In the "Parameters" section you can decide whether you wish to multiply the received results by a given parameter or to add a given parameter to the results.



In the picture below you can see an example of results which were multiplied by the parameter [-1]. Please note that in the Chart Wizard's main view you can find both the initial results and results affected by the curve operation routine (they will be displayed in different colors). Curve created as a result of the curve arithmetical operations will have a "Operated" prefix added to its name.



Curve offset can be defined for selected results series.

**Operations:**

- SAE Filters
- Low pass 2nd order Butterworth filter (BF)
- Truncated Fourier series (FFT)
- Moving Averages (MA)
- Curve Arithmetical Operations
- Curve Offset**
- Curve Mirror
- Results Operations
- Remember Series

**Parameters:**

Offset Parameters Apply

X Offset:

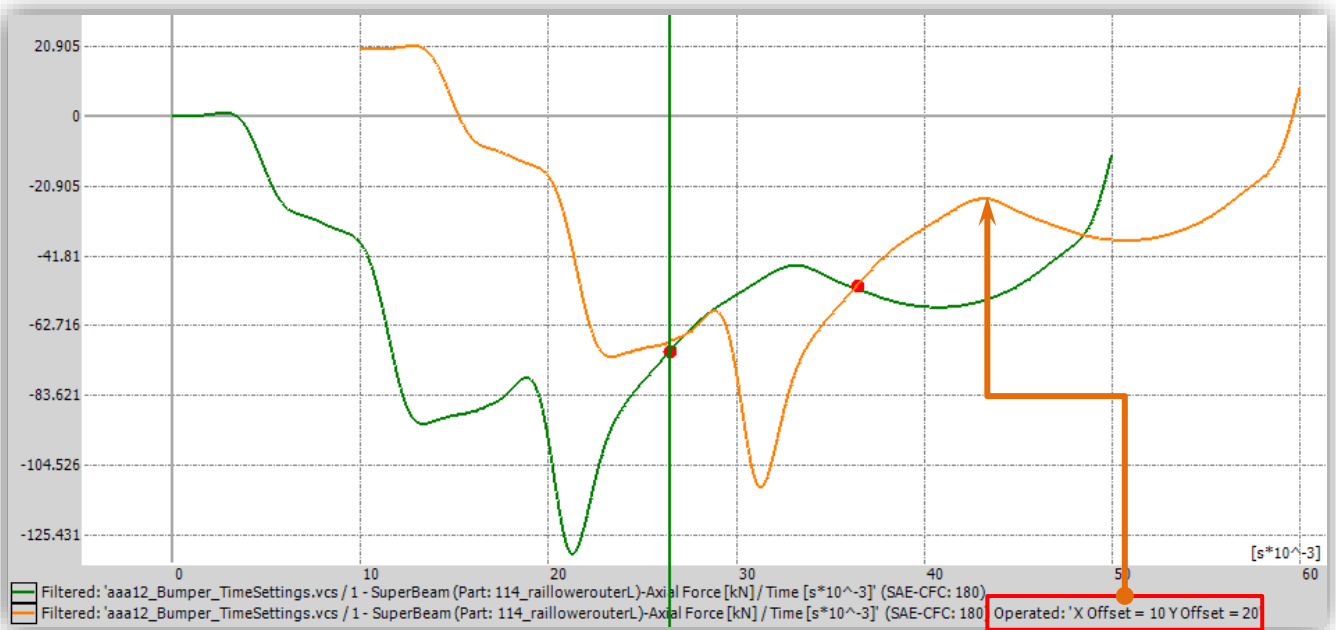
X Scale:

Y Offset:

Y Scale:

After selecting the "Curve Offset" option you can define the curve's offset or scale along the X or Y axis.

All needed definitions should be done in the "Parameters" window (set the offset or scale values).



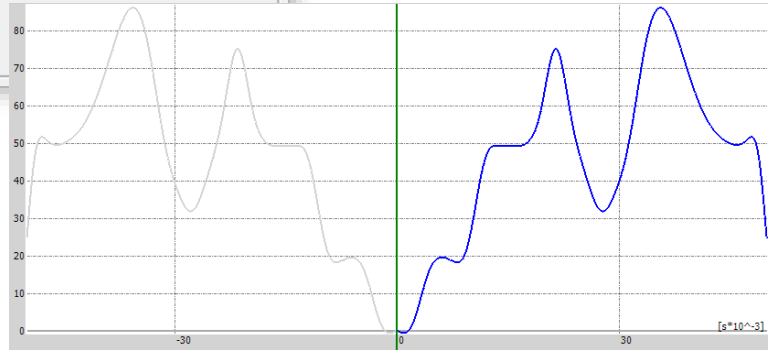
Above please find an example of a series for which an offset along the X and Y axis has been defined (orange curve).

Please note that to the curve name located below the chart a suffix has been automatically added : "Operated : 'X offset = 10; Y offset = 20". The series name includes basic information about the defined curve operations.



|   |   |
|---|---|
| <b>Operations:</b><br><input type="radio"/> SAE Filters<br><input type="radio"/> Low pass 2nd order Butterworth filter (BF)<br><input type="radio"/> Truncated Fourier series (FFT)<br><input type="radio"/> Moving Averages (MA)<br><input type="radio"/> Curve Arithmetical Operations<br><input type="radio"/> Curve Offset<br><input checked="" type="radio"/> <b>Curve Mirror</b><br><input type="radio"/> Results Operations<br><input type="radio"/> Remember Series | <b>Parameters:</b><br>Mirror Parameters <input type="button" value="Apply"/><br>X Mirror: <input checked="" type="checkbox"/><br>Y Mirror: <input type="checkbox"/> |
|---|---|

"Curve Mirror" functionality enables the user to create a curve mirrored with respect to the X or Y axis



The tool "Results Operations" provides the possibility to make several operations on the same series of results for multiple elements of the Solution.

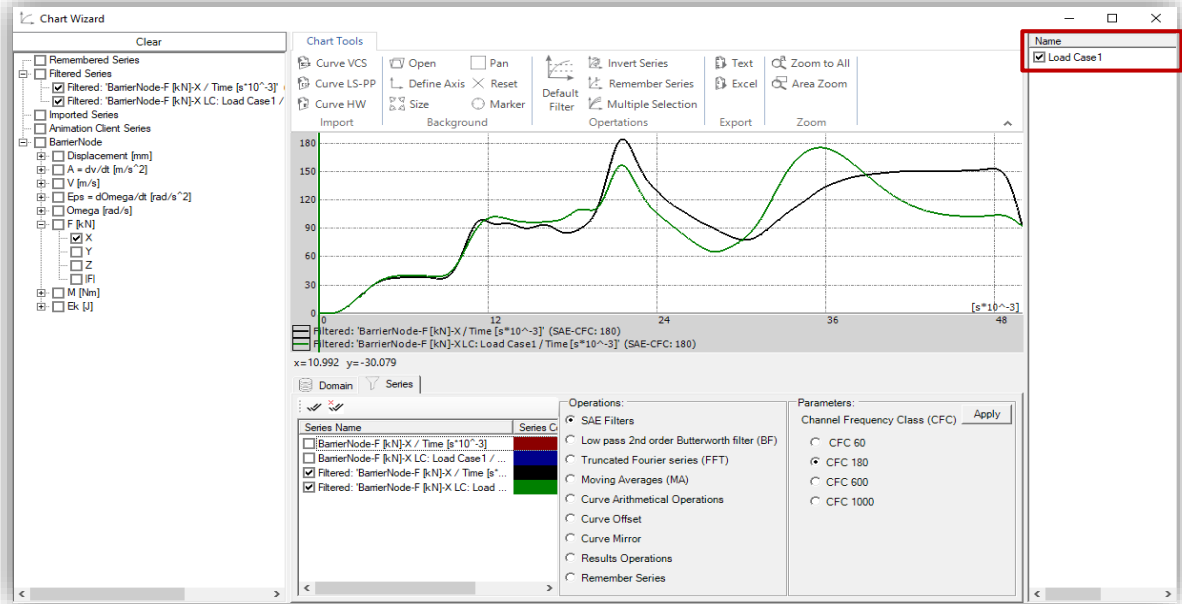
The user can decide to select:

- sum of values
- sum of values modulus
- multiplication of values
- multiplication of values modulus

|   |  |
|---|--|
| <b>Operations:</b><br><input type="radio"/> SAE Filters<br><input type="radio"/> Low pass 2nd order Butterworth filter (BF)<br><input type="radio"/> Truncated Fourier series (FFT)<br><input type="radio"/> Moving Averages (MA)<br><input type="radio"/> Curve Arithmetical Operations<br><input type="radio"/> Curve Offset<br><input type="radio"/> Curve Mirror<br><input checked="" type="radio"/> <b>Results Operations</b><br><input type="radio"/> Remember Series | <b>Parameters:</b><br>Operation <input type="button" value="Apply"/><br><input checked="" type="radio"/> Sum of values<br><input type="radio"/> Sum of values modulus<br><input type="radio"/> Multiplication of values<br><input type="radio"/> Multiplication of values modulus<br><hr/> <input type="checkbox"/> Remove previous series |
|---|--|

## CHART WIZARD – LOAD CASE COMPARISON

In Visual Crash Studio there is a possibility to compare results for an object in number of load cases. This functionality enables the user to easily verify results of various design variants of a structure.



For example, in the picture above each load case contains different geometry of the crash box beam. Comparison of those designs can be viewed in the Chart Wizard window. Please note that in order to compare results of different load cases, each of those load cases must be exported and saved with the usage of the export procedure available in VCS.

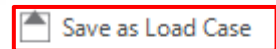
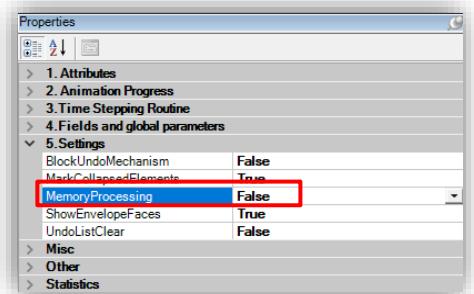
### Export Load Case and Results in text files

All information about the VCS model and the results of calculation procedure can be exported and automatically saved in text format.

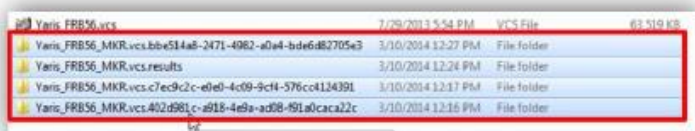
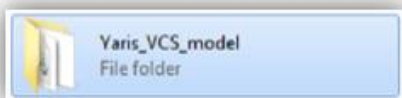
In order to save a VCS Solution and results you need to set the Memory Processing field of the Solution's properties window to False.

After finishing the calculations, click on "Save as Load Case" icon in the "Calculate and Results" section of the main toolbar.

In the New Load Case window you can enter the name under which the solution will be saved



Special



The new Load Case files will be automatically saved in the location of the "base" VCS file. In result of the export procedure, you will receive folders of data, containing all information about the model and load case. Results will be gathered in an individual folder, as illustrated in the picture above.

## CHART WIZARD – PROPERTIES WINDOW

|                      |                                       |
|----------------------|---------------------------------------|
| <b>Appearance</b>    |                                       |
| AxesVisible          | <b>True</b>                           |
| BackgroundColor      | <input type="checkbox"/> <b>White</b> |
| GridVisible          | <b>True</b>                           |
| ScalesVisible        | <b>True</b>                           |
| <b>Grid Settings</b> |                                       |
| GridX                | <b>25</b>                             |
| GridY                | <b>25</b>                             |
| LockGridSettings     | <b>False</b>                          |
| SnapToGrid           | <b>False</b>                          |
| <b>View Extends</b>  |                                       |
| MaxX                 | <b>100</b>                            |
| MaxY                 | <b>100</b>                            |
| MinX                 | <b>-100</b>                           |
| MinY                 | <b>-100</b>                           |

*Left mouse click in the function window to display Chart Properties in main VCS window.*

*This functionality enables to change axes and grid visibility, gridline settings and axes max and min values.*