ME scope

Structure (STR) Window

March 7, 2025

VIBRANT

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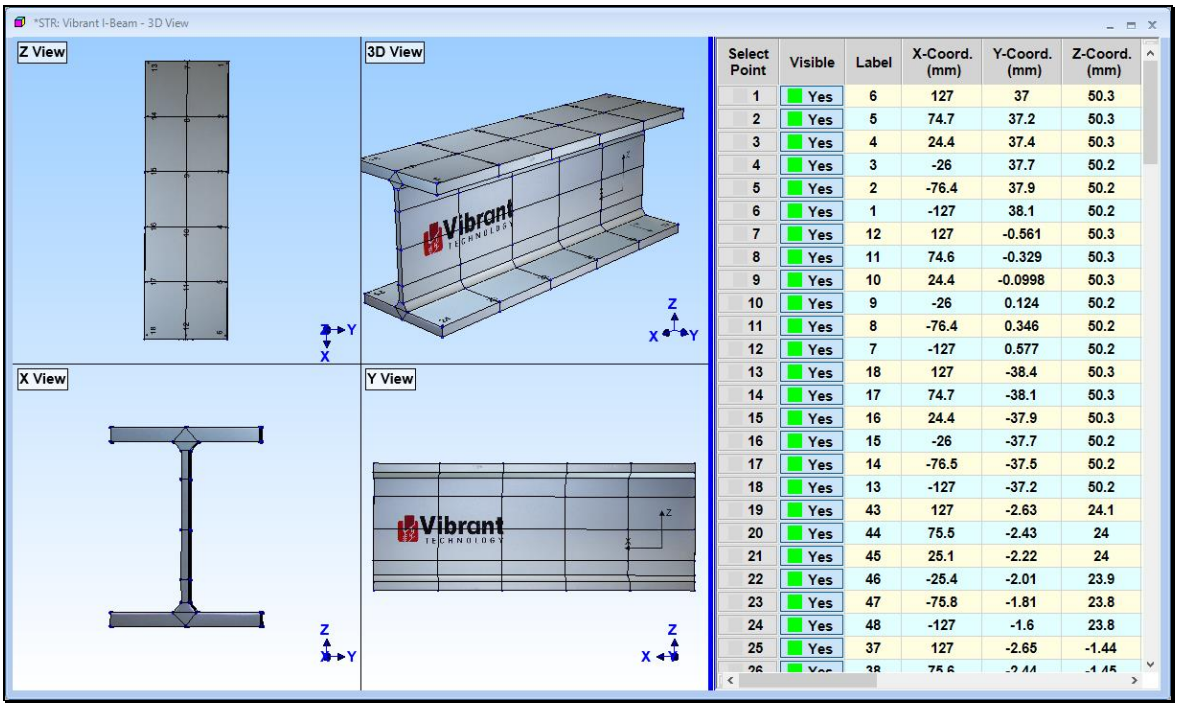
Structure (STR) Window

To ***enlarge*** the text in this manual, ***hold down*** the **Ctrl key** and ***spin the mouse wheel***.



Structure (STR) Window in Quad View.

NOTE: Only the commands for a **VT-620** ***Visual ODS*** Package are documented in this chapter. Additional commands authorized by the **Options** of MEscope are documented in separate chapters. Execute **Help | License Manager** to verify the Options authorized by your MEscope license.

The Structure (STR) window is used for,

1. **Drawing** a 3D structure model
2. **Animating** shape data on the 3D model

Drawing & Animation States

The Structure (STR) window has two states, Drawing & Animation.

In the **Drawing state**, you can interactively draw and modify a 3D model of the test article

In the **Animation state**, shapes from the ***current*** **Animation Source** are displayed in animation on the 3D model

Animation Sources

Any Data Block (**BLK**), Shape Table (**SHP**), or Acquisition **(ACQ)** window can be an Animation Source.

All Animation Sources are listed in the **Animation Source list** on the Structure **(STR)** window Toolbar or Ribbon.

Graphics Area & Objects Spreadsheet

The Structure (STR) window contains a graphics area ***on the left*** and a ***current*** Objects spreadsheet ***on the right***, separated by a **vertical blue splitter bar**. The graphics area ***on the left*** contains a 3D model of the structure. The ***current*** Objects spreadsheet ***on the right*** lists the properties of ***all*** Objects of ***the current Object Type***

- ***Drag*** the **vertical blue splitter bar** in the window to make either the graphics area or the current Objects spreadsheet larger

Menu Commands

Menu commands are ordered by command menus ***(from left to right)***, and then by the commands in each menu ***(from top to bottom)***

Each menu command can be executed in three different ways,

- Choosing it from a command **menu**
- ***Clicking*** on its **Tool** if it is on a menu **Toolbar**
- ***Clicking*** on it in a menu **Ribbon**

Mouse & Keyboard Operations

Right Click Menus

- ***Right click*** on a **spreadsheet** to display a menu of ***frequently used*** spreadsheet commands
- ***Right click*** *on a* **graphics area** to display a menu of ***frequently used*** window commands

Re-Ordering Spreadsheet Columns

- ***Click*** & ***drag*** its **column header** to move a spreadsheet column to a new position

Spreadsheet Vertical Scrolling

- If a ***vertical scroll bar*** is displayed on the ***right side*** of a spreadsheet, place the ***mouse pointer over the spreadsheet*** and ***spin the mouse wheel*** to ***scroll*** the spreadsheet vertically

Spreadsheet Text Size

- To change the text size in a spreadsheet, place the ***mouse pointer over the spreadsheet***, ***hold down*** **the Ctrl key**, and ***spin the mouse wheel***

Cut, Copy & Paste Text

Select one or more spreadsheet text cells

- ***Hold down*** **the Ctrl key** and,
  - ***Press*** **the X key** to cut the selected text to the Windows Clipboard
  - ***Press*** **the C key** to copy the selected text to the Windows Clipboard
  - ***Press*** **the V key** to paste text from the Windows Clipboard into the selected cells

Rotation in the 3D View

- Move the mouse pointer into the **3D View**, hold down the ***right mouse button*** and ***drag*** the mouse to rotate the structure model

Zoom In or Out on the Structure Model

- ***Click*** in the graphics area, and ***spin*** the **mouse wheel** to Zoom In or Zoom Out out on the structure model
- Execute **Display | Re-Center All Views** to recover the full display of the structure model

Panning the Structure Model

- Move the mouse pointer into a **View**, hold down the ***CTRL*** key on the keyboard and ***drag*** the mouse pointer to pan the structure model in the View

Selecting Objects in the Objects Spreadsheet

- ***Click*** on a **Select** button of the ***first*** Object in the Objects Spreadsheet
- ***Hold down*** the **Shift** key, and ***click*** on the **Select** button of the ***last* Object** to ***select*** all Objects between the ***first*** and ***last* Object**

Arrow Keys During Dwell Animation

- ***Press*** the **Left or Right Arrow key** on the keyboard to move the cursor ***left or right*** in the ***connected*** Data Block (**BLK**) or Acquisition (**ACQ**)
- ***Press*** the **Left or Right Arrow key** on the keyboard to display the ***next or previous*** shape in the ***connected*** Shape Table (**SHP**)

Objects Spreadsheet

The properties of each modeling Object are displayed and edited in the Objects Spreadsheet. Only the properties of the current Objects selected in the **Edit** menu are displayed in the Objects Spreadsheet.

- Each **row** contains ***all* properties** of a ***single*** Object
- Each **column** contains a ***single* property** for ***all*** Objects
- Most operations are performed on ***selected* Objects**, or on ***all* Objects** if none are selected

Select Object Column

Selects or Un-selects each Object

- The **Select Object** button contains the ***unique* row number** of each Object in the spreadsheet

Visible Column

Shows or Hides each Object on the structure model

Label Column

Point labels are used for numbering Points and for creating **M# Links** on the structure model.

Color Column

The color of each Object on the structure model

Object Size or Width Column

Point sizes are increased using ***larger dots***. All other Object sizes are increased using ***thicker lines.***

Showing & Hiding Spreadsheet Columns

- ***Right click*** on any spreadsheet and execute **Show/Hide Columns** from the menu
- In the dialog that opens, ***check*** columns to show them, and ***un-check*** columns to hide them

Reset Spreadsheet Column Widths

- ***Right click*** on any spreadsheet and execute **Reset Column Widths** from the menu

Re-Ordering Spreadsheet Columns

- ***Drag*** the **column header** to move a column to a new position

Scroll Bars

Vertical and horizontal scroll bars are displayed if there is more data to display in an **Objects Spreadsheet**

- To scroll ***vertically***, place the mouse pointer on the spreadsheet and ***spin the mouse wheel***

- To scroll ***horizontally***, ***drag*** the horizontal scroll bar

Spreadsheet Text Size

To change the text size in a spreadsheet,

- Place the mouse pointer on the spreadsheet, ***hold down*** the **Ctrl key**, and ***spin the mouse wheel***

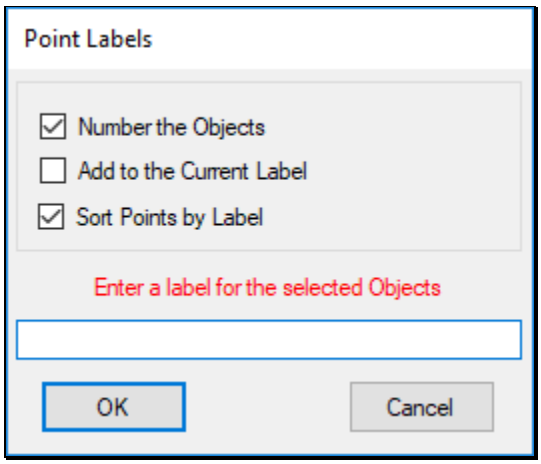
Cut, Copy & Paste Text

Select one or more spreadsheet text cells

- ***Hold down*** the **Ctrl key** and,
  - ***Press*** the **X** key to **cut** the ***selected*** text to the Clipboard
  - ***Press*** the **C** key to **copy** the ***selected*** text to the Clipboard
  - ***Press*** the **V** key to **paste** text from the Clipboard into the ***selected*** cells

Editing Spreadsheet Properties by Column

- Select an Object type in the **Edit** menu to display its **Objects** spreadsheet
- ***Select*** the Objects to be edited, or ***un-select all*** Objects to edit the properties of ***all*** Objects
- ***Double click*** on the **column heading** for the property to be edited
- Choose or enter a property value in the dialog box that opens, and ***click*** on **OK**



Points Spreadsheet

NOTE: *Only* Points are required for displaying shapes in animation. All other ***Drawing Objects*** on a model require Points as endpoints to define them.

The Points spreadsheet lists the properties of ***all Points*** on the structure model. The **Points** spreadsheet is displayed by selecting **Points** in the **Edit** menu.

Each Point is defined by its ***global coordinates***, (**X Coord. , Y Coord. , Z Coord**.) listed in its ***row*** of the Points spreadsheet.

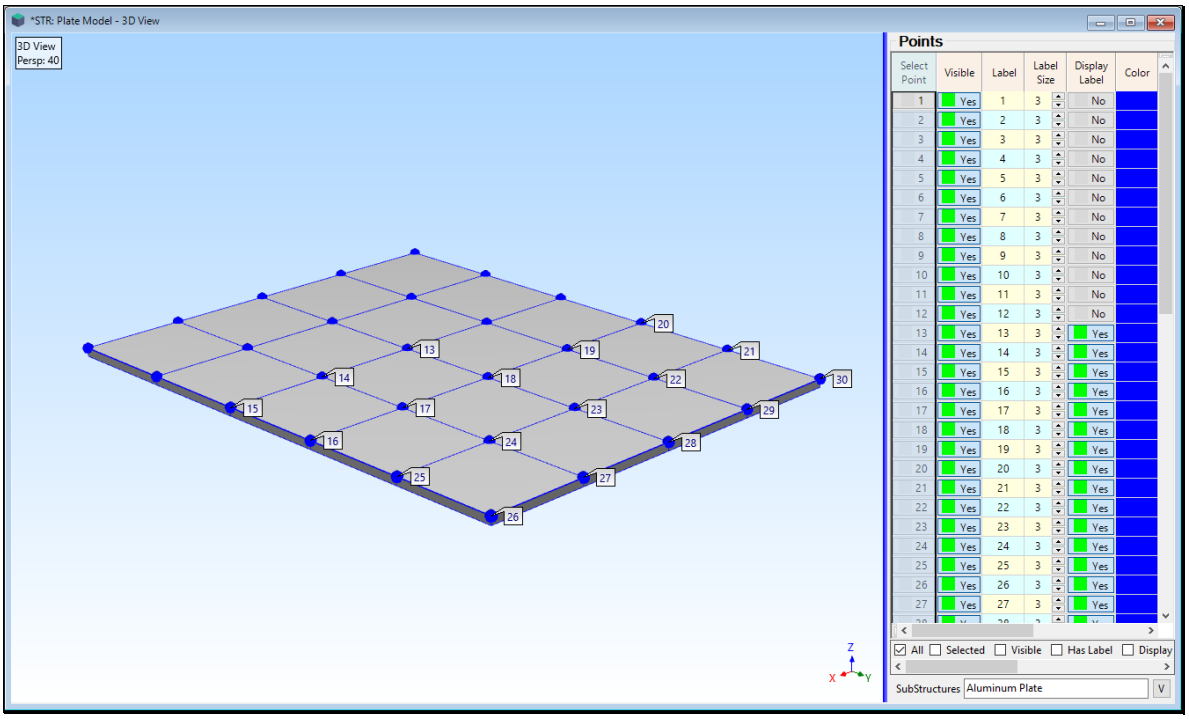
- Spreadsheet **columns** can be re-ordered by ***dragging & dropping*** them into a new position
- ***Selected*** spreadsheet rows can be moved by executing **Edit | Move Objects Up or Down**

Label Column

This column contains an (**optional**) text label for each Point

- Point Labels are used for Point numbering or to describe a Point
- All Points are referenced by their spreadsheet **row number** & **[Label]**

- Numbered Point Labels are used by the **M# Links | Measured Links** command



Point Properties Spreadsheet Showing Some Point with Display Label ➔ Yes.

Display Label Column

When **Display | Points | Point Labels** is executed, a Point Label will be displayed if **Display Label** is ***set to*** **Yes** in this column.

- **Warning:** A Point Label is displayed only at those Points with **Display Label** set to **Yes** in the Points spreadsheet

Point Coordinates Columns

These columns (**X Coord, Y Coord** & **Z Coord**) contain the Global rectangular (Cartesian) coordinates of each Point.

- **Length** units are specified on the **Units** tab in the **File | Structure Options** dialog box

NOTE: ***Correct length units are not required*** to animate a shape on a 3D model.

Typing in Point Coordinates

To manually enter Point coordinates from the keyboard,

- ***Click*** in the **X Coord, Y Coord or Z Coord** column of the ***last row*** of the Points spreadsheet
- ***Press*** the ***Down Arrow*** **key** on the keyboard
- Type new coordinates into the Point **Coordinate** columns for the new Point

Pasting Coordinates from the Clipboard

If you have copied Point coordinates to the **Windows Clipboard**, they can be pasted into the **Points** spreadsheet.

- Ensure that there are enough rows in the **Points spreadsheet** before pasting coordinates from the Clipboard.

To paste Point coordinates from the Clipboard,

- ***Click & drag*** in the Points spreadsheet to ***select*** the appropriate **Coordinate columns and rows** of spreadsheet cells
- ***Hold down*** the **Ctrl key** and ***press* the V key** to paste the coordinates from the **Windows Clipboard** into the ***selected*** cells

Display Always Column

Normal

Displays a Point if Points is the current Object Type or **Display | Points | Show Points** is ***checked***.

Always

Always displays a Point unless **Visible ➔ No** for the Point.

Center Points & Radial Points

Center Point

A center Point is any Point that is listed in the **Center Poin**t column of another Point in the Points spreadsheet.

Radial Point

Any Point that lists a **Point** in its **Center Point** column in the Points spreadsheet.

Center Points are used for

- Describing the center of ***cylindrical*** or ***spherical*** structures
- Defining the axis of rotation for ***rotating* Substructures** during animation

Rotating Substructure

During shape animation, if **Yes ➔** in the **Rotation column** for a substructure of the **Substructures** spreadsheet, all the Points referenced by the substructure will ***rotate about their Center Point***.

All **Radial Points** of a rotating Substructure will rotate about the **Z-axis** of their **Center Point**

Display Translation Column

If **Display Translation ➔ Yes** for a Point, deflection will occur at the Point using shape data from the ***current*** Animation Source.

Deflection | Translation must be ***checked*** for translation to occur at a Point where **Display Translation ➔ Yes**.

Display Vectors Column

If **Display Vectors ➔ Yes** for a Point, a deflection vector will be displayed at the Point using shape data from the ***current*** Animation Source.

Deflection | Vectors must be ***checked*** for deflection to occur at a Point where **Display Vectors ➔ Yes.**

Display Orbits Column

If **Display Orbits ➔ Yes** for a Point, an orbit will be displayed at the Point using shape data from the ***current*** Animation Source.

Deflection | Orbits must be ***checked*** for an orbit to be displayed at a Point where **Display Orbits ➔ Yes**

Display [Mag & Phs] Column

If **[Mag & Phs] ➔ Yes** for a Point, magnitude & phase will be displayed at the Point using shape data from the ***current*** Animation Source.

Deflection | [Mag & Phs] must be ***checked*** for magnitude & phase to be displayed at a Point where **Display [Mag & Phs] ➔ Yes**

ICON Column

Displays an ICON at a Point. An ICON is useful for depicting the type of sensor used at a test Point.

- For example, a **cube** depicts a tri-axial accelerometer and a **cylinder** depicts a uni-axial accelerometer

Rotating a Point ICON

An ICON can be rotated to indicate the correct direction of measurement at a Point.

- ***Select*** the Points with ICONs to be rotated
- Execute **Draw | Rotate Objects** and ***check*** **Rotate Point ICONs** in the dialog box that opens

Resizing a Point ICON

- ***Select*** the Points with ICONs to be resized
- Execute **Draw | Resize Objects** and ***click*** **on Yes** in the dialog box that opens

Acoustic Area & Normal Columns

Used for calculating the Sound Power passing through an **acoustic surface.**

Acoustic Area

The area of the acoustic surface surrounding a Point on an acoustic surface.

Acoustic Normal

The normal vector to the acoustic surface surrounding a Point

- When an acoustic surface it created with the **Drawing Assistant**, values in the Acoustic Area & Normal Columns are ***automatically calculated*** for the acoustic surface

Adding Points to a Model

Adding Points Graphically

- Choose **Points** from the **Edit** menu
- Execute **Edit | Add Objects** to ***enable*** the Add Points operation
- Move the mouse pointer into a desired position in a View and ***click*** to add a Point
- Execute **Edit | Add Objects** ***again*** to ***terminate*** the Add Points operation
- Each new Point is added to the structure model and to the **Points spreadsheet**

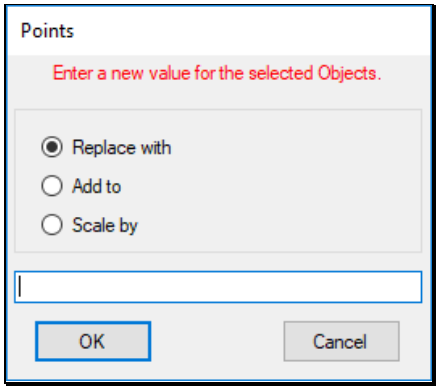
WARNING: When **Edit | Add Objects** is ***checked***, ***each click*** of the left mouse ***will add a new Point*** to the structure model.

Adding Points to the Points Spreadsheet

- Click in the ***last row*** of the **X Coord, Y Coord** or **Z Coord** column in the Points spreadsheet
- ***Press*** the **Down Arrow** key on the keyboard to add a new Point
  - The coordinates of the ***previous row*** are copied into the new row when a new Point is added to the spreadsheet
  - The coordinate in the ***selected*** cell is incremented by the ***difference*** between the ***previous two*** coordinates in its column, or by "**1**" if there is no difference

Editing Point Coordinates

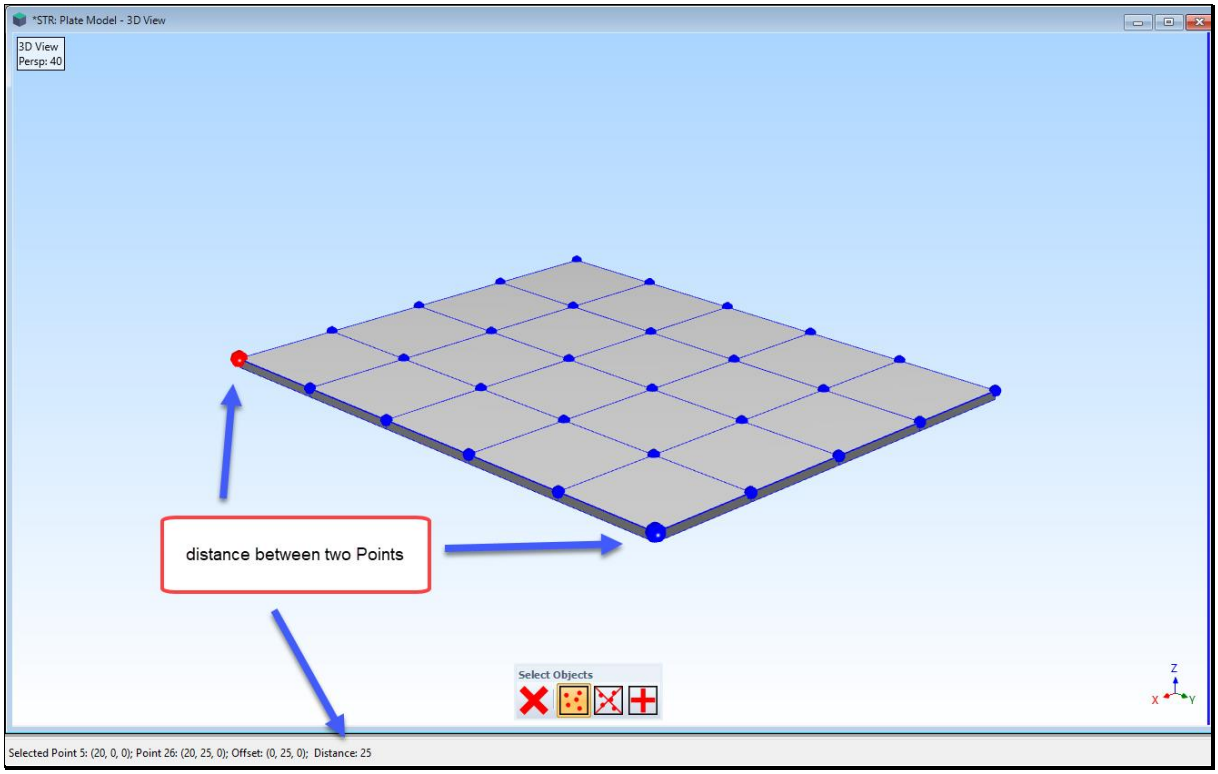
- ***Select*** the Points with coordinates to be edited
- ***Double click*** on the appropriate **X-Coord**, **Y-Coord** or **Z-Coord column** heading to edit the coordinates of the ***selected*** Points
  - In the dialog box that opens, choose **Replace with**, **Add to** or **Scale by**
  - Enter the new coordinate value into the box and ***click*** on **OK**



Distance Between Two Points

The distance between two Points is displayed on the **Status** bar at the bottom of the MEscope window.

- Choose **Points** from the **Edit** menu
- Execute **Edit | Select Objects | Interactive** and ***click near*** a Point to ***select*** it
- When you move the mouse Pointer ***near*** to a ***second*** Point, its coordinates and the distance between the two Points is displayed on the **Status** bar



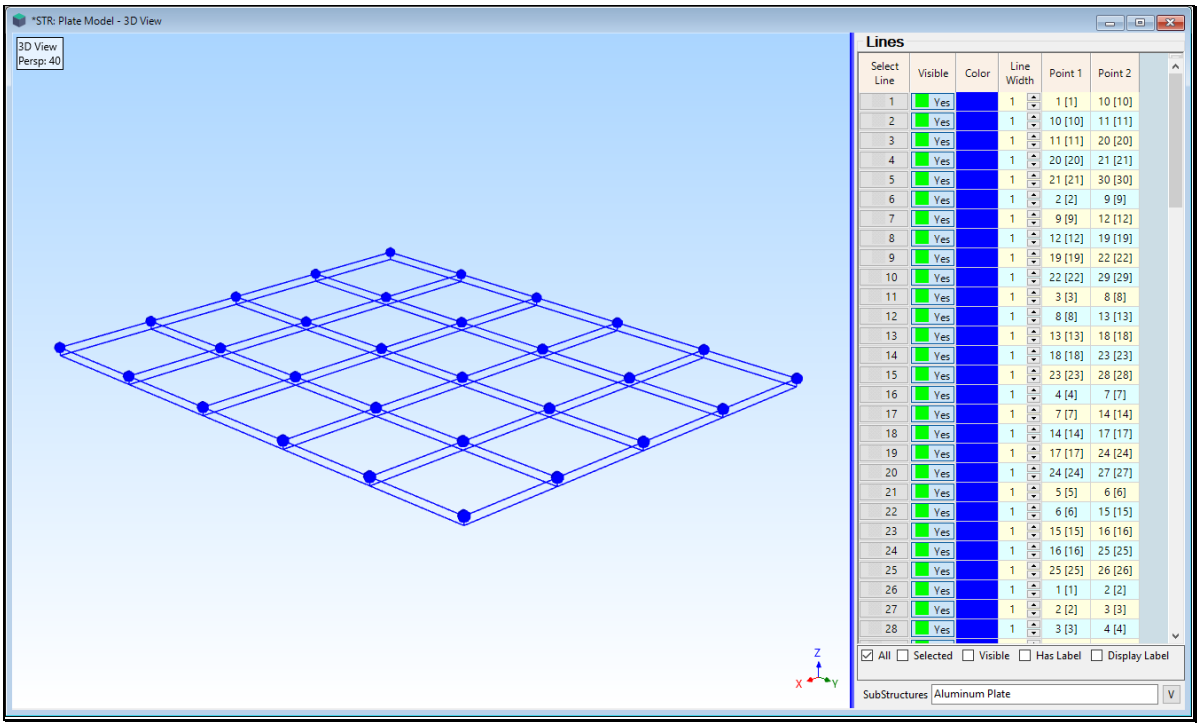
Distance Between Two Points Shown on Status Bar.

Lines Spreadsheet

Lists the properties of ***all*** **Lines** on the structure model. The **Lines spreadsheet** is displayed by selecting **Lines** in the **Edit** menu.

- Each Line is defined between ***two*** **Points**, labeled **Point 1** and **Point 2** in its ***row*** of the **Lines** spreadsheet
- Each end point (**Point 1** or **Point 2**) is defined by its ***row number*** in the **Points** spreadsheet followed by its optional **[Point Label]**

- ***Selected*** Lines spreadsheet rows can be moved by executing **Edit | Move Objects Up** or **Down**



Lines Spreadsheet.

Adding Lines to a Model

- Choose **Lines** from the **Edit** menu
- Execute **Edit | Add Objects** to ***enable*** the Add Lines operation
- ***Click near*** the ***first*** end Point of the new Line to ***select*** it
  - If you ***select*** the ***wrong*** Point, ***click*** on it again to ***un-select*** it
- ***Click near*** the ***second*** end Point to add a **new Line** to the model, and a ***new row*** to the **Lines** spreadsheet

WARNING: When **Edit | Add Objects** is ***checked***, a **new Line** will be added to the model each time you ***click near two different*** Points in succession.

- Execute **Edit | Add Objects** ***again*** to ***terminate*** the Add Lines operation

Surfaces Spreadsheets

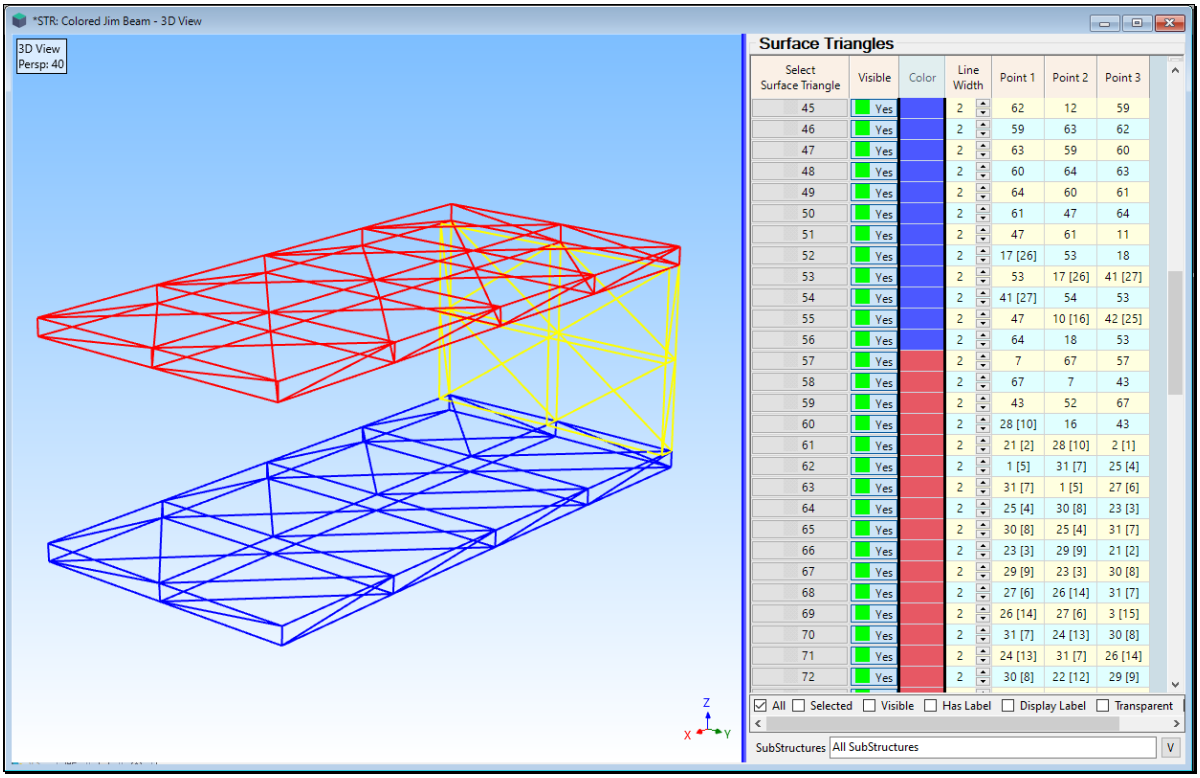
These two spreadsheets contain the properties of ***all*** **Surface Triangles** and ***all*** **Surface Quads** on a structure model. Surfaces are required for displaying **solid models**, **surface textures,** or **contour colors** during animation.

- **Spreadsheet columns** can be re-ordered by ***dragging & dropping*** them into a new position
- ***Selected*** spreadsheet rows can be moved by executing **Edit | Move Objects Up** or **Down**

Surface Triangles Spreadsheet

The Surface Triangles spreadsheet is displayed by selecting **Surface Triangles** in the **Edit** menu

- Each Surface Triangle is defined between ***three*** corner Points **(Point 1, Point 2, Point 3**)
- Each corner Point (**Point 1, Point 2, Point 3)** of a Surface Triangle is defined by its ***row number*** in the **Points** spreadsheet followed by its optional **[Point Label]**



Surface Triangles Spreadsheet.

Surface Quads Spreadsheet

Surface Quads spreadsheet is displayed by selecting Surface Quads in the **Edit** menu

- Each Surface Quad is defined between ***four*** corner Points (**Point 1, Point 2, Point 3, Point 4**)
- Each corner Point (**Point 1, Point 2, Point 3, Point 4**) of a Surface Quad is defined by its ***row number*** in the **Points** spreadsheet followed by its optional **[Point Label]**

Adding Surfaces to a Model

- Choose **Surface Triangles** or **Surface Quads** from the **Edit** menu
- Execute **Edit | Add Objects** to ***enable*** the Add operation
- ***Click near*** the ***first*** corner Point of the new Surface to ***select*** it
  - If you select the wrong Point, click near it again to un-select it
- ***Click near*** the ***second*** corner Point of the Surface to ***select*** it
- ***Click near*** the ***third*** corner Point of the Surface to ***select*** it
- If adding Surface Triangles, when you ***click near*** the ***third corner Point***, a new Surface Triangle is added to the model, and a ***new row*** is added to the **Surface Triangles** spreadsheet
- If adding Surface Quads, when you ***click near*** the ***fourth*** corner Point, a new Surface Quad is added to the model, and a ***new row*** is added to the Surface Quads spreadsheet

WARNING: When **Edit | Add Objects** is ***checked***, a ***new*** Surface Triangle will be added to the model after you ***click near three Points*** in succession, and a new **Surface Quad** will be added after you ***click near four Points*** in succession

- Execute **Edit | Add Objects** ***again*** to ***terminate*** the Add Surfaces operation

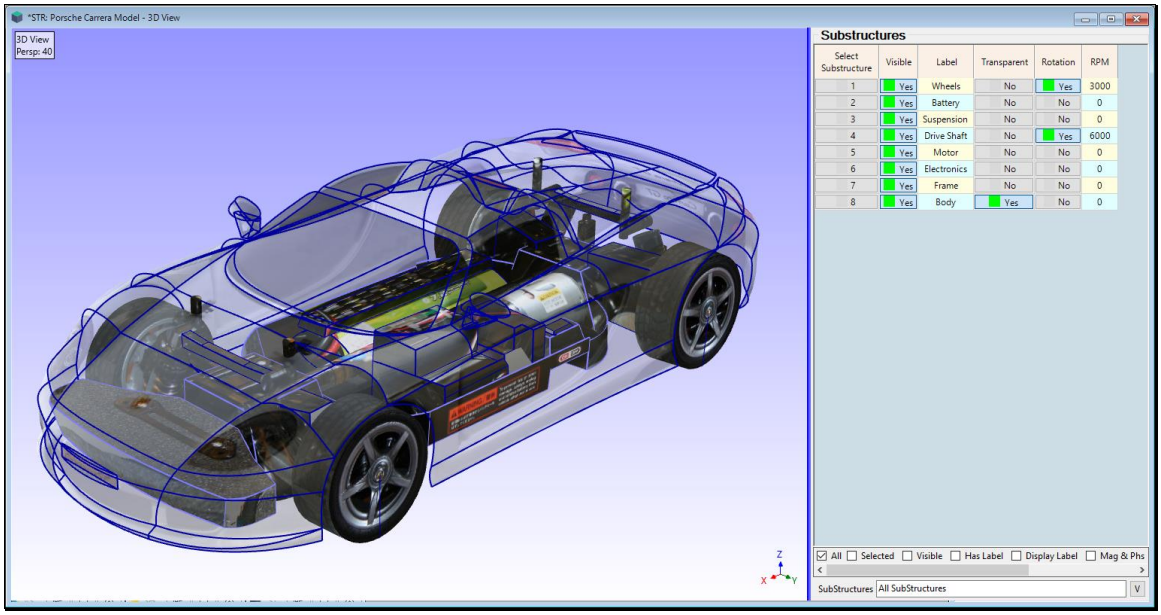
Substructures Spreadsheet

A Substructure is a collection of ***referenced*** **Points**, **Lines** & **Surfaces.**

The **Substructures** spreadsheet contains the properties of ***all*** **Substructures** defined for the structure model

Substructures are useful for,

- Creating more complex structure models by creating ***several smaller parts*** with simpler geometries
- Making portions of a structure model ***invisible*** so that it is easier to draw a model, create **M# Links** fro animating shapes, and viewing shape data in animation
- Making portions of a structure model ***transparent*** so that complex shapes are easier to view during animation



A Model Showing a Transparent Body Substructure.

Object Properties Column

The ***colors & sizes*** of the Objects referenced by each Substructure are defined in this column.

The **color bars** for each Substructure contain the colors of the **Points**, **Lines**, & **Surfaces** that are referenced by that Substructure.

- If an **(X)** symbol is displayed in place of a **color bar**, the Objects referenced by the Substructure have ***more than one color***

If the **Points**, **Lines**, or **Surfaces** color is changed in the **Substructure** spreadsheet, the color of ***all*** **Objects** referenced by the Substructure will be changed.

- ***Double click*** on the **Object Properties column** heading to change the ***color & size*** properties of ***all (or selected)*** Substructures in the Substructures spreadsheet

Transparent Column

Used to display ***all Surfaces*** referenced by the Substructure as ***transparent surfaces***.

Hide Texture Column

Used to show or hide surface textures of ***all Surfaces*** referenced by a Substructure.

Contours Data Type Column

Defines the type of data displayed during animation using color contours on the ***Surfaces referenced*** by a Substructure.

NOTE: Deflection | Contours | Color Contours must be ***checked*** to display color contours.

Translation

If chosen, only **Translation** data is displayed using color contours.

Machine Rotation

If chosen, only **Shaft Rotation** data is displayed using color contours.

Scalar

If chosen, only **Scalar data** is displayed using color contours.

None

If chosen, **No** color contours are displayed on the ***Surfaces referenced*** by the Substructure.

Creating a Substructure

A substructure can be created in two ways,

1. Add one to a model drawing using the **Drawing Assistant**
2. Select other Objects and execute **Draw | Substructures | Add Objects**
   - *See* **Draw | Substructures | Add Objects** command description for details

Rotating Substructure

Components of a machine or structure can be made to rotate during animation by defining each component as a rotating Substructure

- Select **Yes** in the **Rotation** column in the **Substructures** spreadsheet to make a Substructure rotate during shape animation
- Enter a ***non-zero speed*** in the **RPM** column of the Substructure with **Yes** in its **Rotation column**
- During shape animation the **Radial Points** of each rotating Substructure will rotate about their **Center Point**
- Each Radial Point rotates about the Z-axis of the **Measurement Axes** of its Center Point
- If **"None"** is ***selected*** in the **Animation Source** list, all Substructures setup for rotation will rotate when animation is initiated
- The rotational speed of all rotating Substructures is ***scaled*** to the speed (in **RPM** or **Hz**) of the shape being animated.
  - For example, if the RPM of a rotating Substructure is equal to the ***running speed*** of a machine, each cycle of animation of its **first order ODS** will coincide with the rotation of the rotating Substructure

Creating a Rotating Substructure

Each Radial Point of a Rotational Substructure ***will only rotate about the* Z-Axis of its Center Point.**

- Create the Substructure to be rotated, and ***select*** the Substructure
- Execute **Draw | Create Center Point** to create a Center Point for the Substructure
- Execute **M# Links | Measurement Axes**
- On the **Measurement Axes** tab, orient the Measurement Axes of the Center Point so that its **Z-Axis** coincides with the desired axis of rotation
- Set **Rotation ➔ Yes** in the **Rotation** column of the **Substructures** spreadsheet

- ***Enter*** the RPM into the **RPM** column of the **Substructures** spreadsheet

Testing the Rotation

- Select **"None"** in the **Animation Source** list on the Structure (**STR**) window Toolbar
- Execute **Animate | Animate a Shape**

File Menu

File | Save Structure

Saves the Structure (**STR**) file in the current Project.

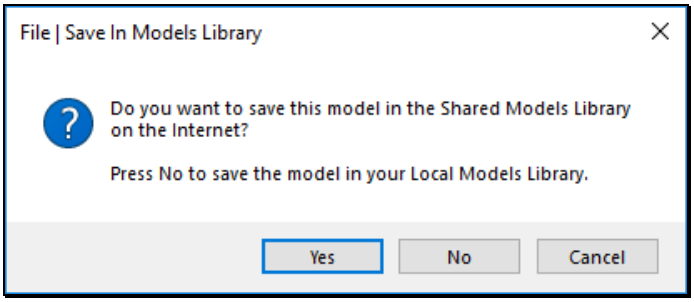
File | Save Structure As

Saves a ***copy*** of the Structure (**STR**) file in the ***current Project*** with a ***new name***.

File | Save In Models Library

Saves the structure model in either the **Shared Models Library** on the Internet or in your **local Models Library.**

When this command is executed, the following dialog box will open



- You can choose to save the model your local **Models Library** or in the **Shared Models Library**

All models in your local **Models Library** are displayed in the **Substructures** browser when the **Drawing Assistant** tabs are displayed

- ***See*** Using the Drawing Assistant for details

If your **Software Maintenance & Support (SMS)** is current, you can download models from the **Shared Models Library** and use them in MEscope. ***Click*** on the **Models Library** link on the MEscope **Start Page** to access the Shared Models Library.

Saving Substructures in the Models Library

- Select one or more desired Substructures
- Execute **Edit | Copy Objects to File** and copy the selected Substructures to a new Structure (**STR**) Window
- Execute **File | Save In Models Library** in the new Structure (STR) Window to save the Substructures into the Models Library

File | Save Graphics in a File

Saves the Structure model graphics into a graphics file.

- Graphics files can be saved in the **JPG, GIF, PNG or BMP** file formats

File | Export Structure

Exports the model in the Structure **(STR)** window to a disk file in a third-party file format.

When this command is executed, the **Windows File Save** dialog box is opened. All third-party file formats for exporting Structure (**STR**) files are listed in the **Save as type** list

- Choose an export file format from the **Save as type** list
- Choose a disk folder or create a new one
- Enter the desired file name into the **File name** box and ***click*** on **Save**

Exporting a UFF File

The table below shows the **UFF Data Types** used when data is exported in **UFF** file format.

MEscope File	Type of Data	UFF Data Type
Structure (**STR**)	Structure Points & Lines	15 & 82
Shape Table (**SHP**)	Shapes	55
Data Block (**BLK**)	Time Waveforms, FRFs, Transmissibility's, Auto & Cross Spectra, Fourier Spectra.	58

Exporting a Structure & Shape Table (SHP) into the Same UFF File

- Execute **File | Clone Structure + Source**
- Export the Structure (**STR**) & Shape Table (**SHP**) into the ***same UFF file*** from the cloned Structure & Shape Table files

Importing a Structure Model in Text Format

The spreadsheet file format (with extension **.TXT**) is used to import a Structure model in text format.

1. Create a Text File Template

- Open a Structure **(STR)** window
  - Use any file or one from the **Demos** folder
- Execute **File | Export** and save the file in text format (with extension **.TXT**)

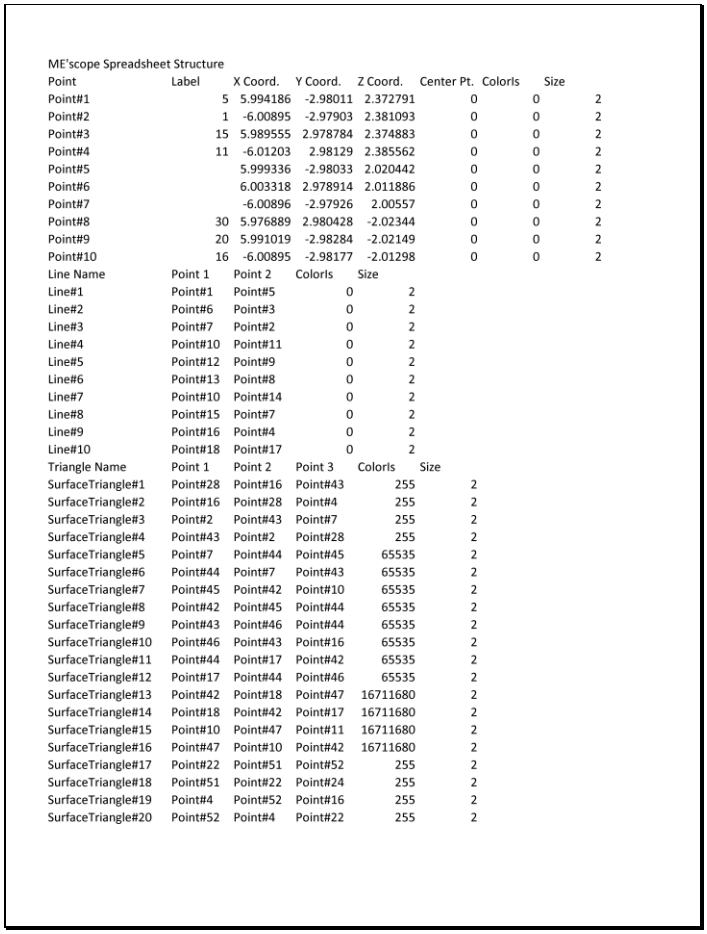
2. Add Your Data to the Text File Template

- Open the (**.TXT**) file in a spreadsheet program like **Microsoft Excel** or a word processor like **Microsoft Word**
- Replace the Structure data (Point coordinates and optionally Lines & Surfaces) in the spreadsheet columns with your data
- Edit the other information where applicable and save the file to disk

3. Import the Text (.TXT) File

Make sure that the (**.TXT**) file is no longer open in the spreadsheet or word processor program

- Execute **File | Import | Structure** and import the (**.TXT**) file into a Structure (**STR**) window



ME'scope Spreadsheet Structure

Point	Label	X Coord.	Y Coord.	Z Coord.	Center Pt.	ColorIs	Size
Point#1	5	5.994186	-2.98011	2.372791	0	0	2
Point#2	1	-6.00895	-2.97903	2.381093	0	0	2
Point#3	15	5.989555	2.978784	2.374883	0	0	2
Point#4	11	-6.01203	2.98129	2.385562	0	0	2
Point#5		5.999336	-2.98033	2.020442	0	0	2
Point#6		6.003318	2.978914	2.011886	0	0	2
Point#7		-6.00896	-2.97926	2.00557	0	0	2
Point#8	30	5.976889	2.980428	-2.02344	0	0	2
Point#9	20	5.991019	-2.98284	-2.02149	0	0	2
Point#10	16	-6.00895	-2.98177	-2.01298	0	0	2

Line Name	Point 1	Point 2	ColorIs	Size
Line#1	Point#1	Point#5	0	2
Line#2	Point#6	Point#3	0	2
Line#3	Point#7	Point#2	0	2
Line#4	Point#10	Point#11	0	2
Line#5	Point#12	Point#9	0	2
Line#6	Point#13	Point#8	0	2
Line#7	Point#10	Point#14	0	2
Line#8	Point#15	Point#7	0	2
Line#9	Point#16	Point#4	0	2
Line#10	Point#18	Point#17	0	2

Triangle Name	Point 1	Point 2	Point 3	ColorIs	Size
SurfaceTriangle#1	Point#28	Point#16	Point#43	255	2
SurfaceTriangle#2	Point#16	Point#28	Point#4	255	2
SurfaceTriangle#3	Point#2	Point#43	Point#7	255	2
SurfaceTriangle#4	Point#43	Point#2	Point#28	255	2
SurfaceTriangle#5	Point#7	Point#44	Point#45	65535	2
SurfaceTriangle#6	Point#44	Point#7	Point#43	65535	2
SurfaceTriangle#7	Point#45	Point#42	Point#10	65535	2
SurfaceTriangle#8	Point#42	Point#45	Point#44	65535	2
SurfaceTriangle#9	Point#43	Point#46	Point#44	65535	2
SurfaceTriangle#10	Point#46	Point#43	Point#16	65535	2
SurfaceTriangle#11	Point#44	Point#17	Point#42	65535	2
SurfaceTriangle#12	Point#17	Point#44	Point#46	65535	2
SurfaceTriangle#13	Point#42	Point#18	Point#47	16711680	2
SurfaceTriangle#14	Point#18	Point#42	Point#17	16711680	2
SurfaceTriangle#15	Point#10	Point#47	Point#11	16711680	2
SurfaceTriangle#16	Point#47	Point#10	Point#42	16711680	2
SurfaceTriangle#17	Point#22	Point#51	Point#52	255	2
SurfaceTriangle#18	Point#51	Point#22	Point#24	255	2
SurfaceTriangle#19	Point#4	Point#52	Point#16	255	2
SurfaceTriangle#20	Point#52	Point#4	Point#22	255	2

***TXT** File in Excel Spreadsheet Format.*

File | Copy to Clipboard | Copy Graphics

Copies the currently displayed graphics area to the Windows Clipboard.

File | Copy to Clipboard | Copy Objects Spreadsheet

Copies the currently displayed ***current* Objects spreadsheet** to the Windows Clipboard.

File | Print | Graphics

Prints the currently displayed graphics on the system printer, or into a PDF file.

The installed Windows printer must be a graphics printer to use this command

File | Print | Spreadsheet

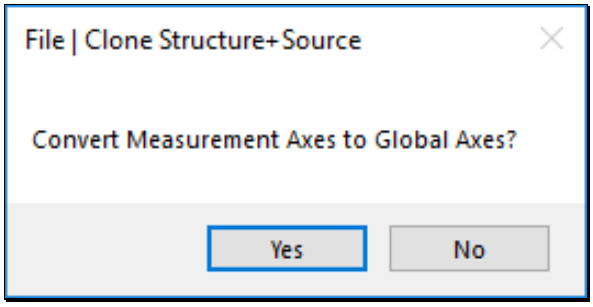
Prints the currently displayed ***current* Objects spreadsheet** on the system printer, or into a PDF file.

The installed Windows printer must be a graphics printer to use this command

File | Clone Structure + Source

Copies both the Structure (**STR**) file and its ***current*** **Animation Source** file into new Structure & Source windows.

- When this command is executed, dialog boxes will open allowing you to name the new Structure & Source files



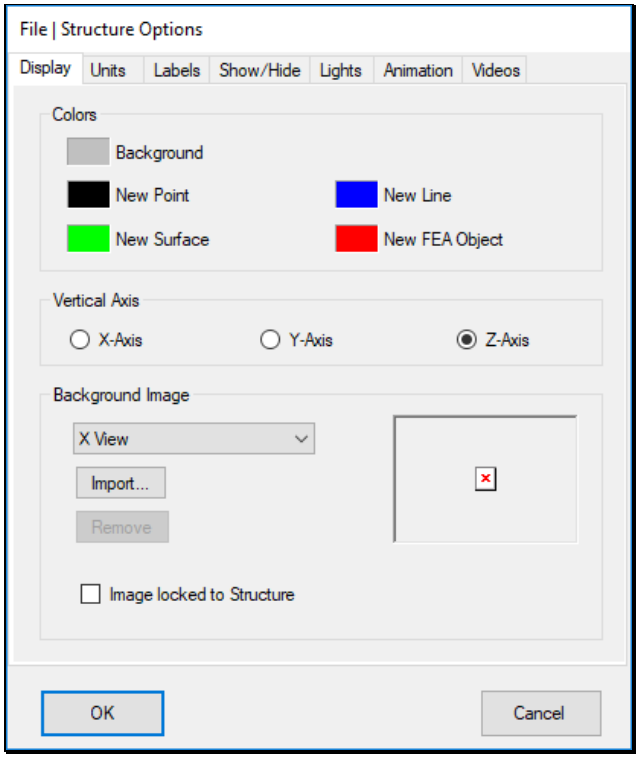
Measurement to Global Axes Dialog Box.

- ***Click* on No** to maintain the current **Measurement Axes** and **M# Links** in the cloned files
- ***Click* on Yes** to convert the **Measurement Axes** and **M# Links** to Global coordinates in the cloned files

File | Structure Options

Opens the Structure Options box.

The options chosen in this box are saved with the **STR** file in the Project.



Display Tab

Colors Section

Choose colors for the **background** and **new Objects**

Vertical Axis Section

Choose which global axis to display as the **Vertical Axis** of the structure model

Background Image Section

Choose a digital photograph (.**JPG**) file to insert into the **background** of the **X-View, Y-View or Z-View**

Image Locked to Structure

If ***checked***, the Point coordinates of the model remain fixed in relation to the background image.

- After tracing from the background Image is completed***, un-check*** **Image locked to Structure**

Labels Tab

Axes Lines

If ***checked***, a line is displayed for each Global (**X, Y, Z**) axis in each View.

- The axis line arrows begin at the Global **(X, Y, Z)** origin
- The **color** of the axis lines is chosen by ***clicking*** in the color box next to **Axis Lines**

XYZ Axes

If ***checked***, the Global (X, Y, Z) Axes are displayed in the ***lower right corner*** of each View.

Legend

If ***checked***, a legend box is displayed in each View.

- ***Click & drag*** to move the Legend in all Views
- The text **color** in the Legend can be chosen by ***clicking*** on the color box next to the Legend

User Label

If ***checked***, the contents of the text box are added to the Legend.

Object Labels

If **Label Background** is ***checked***, *a* background box is drawn around each Object label.

If **Transparent Background** is ***checked***, the Label background is made transparent.

Show Hide Tab

Shows or Hides columns of the Objects spreadsheet.

- ***Check*** columns to show them, ***un-check*** columns to hide them

Right click on the ***current*** Objects spreadsheet and select **Show Hide Columns** from the menu to display this tab.

Lights Tab

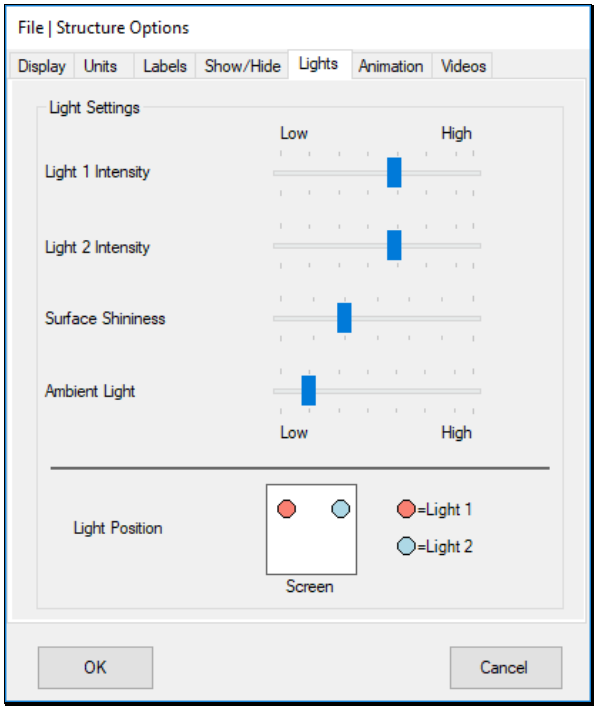
Used for controlling **two surface lights** in the Structure **(STR)** window.

Light Controls

- Adjust the **Intensity** of each light between Low & High
- Adjust the **Shininess** of the structure model **Surfaces** between Low & High
- Adjust the **Ambient light** between Low & High

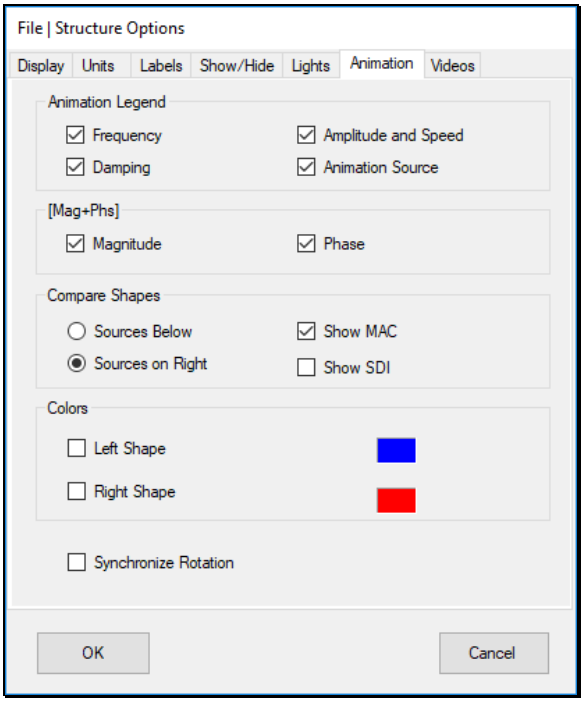
Light Positions

- ***Drag*** the **red** or **blue** light ICON in this area to re-position the light in the Structure **(STR)** window



Animation Tab

Used for setting up shape animation in the Structure (**STR**) window.



Animation Legend Section

If **Frequency** is ***checked***, the frequency of the shape is listed in the Legend

If **Damping** is ***checked***, the damping of the shape is listed in the Legend

If **Amplitude and Speed** is ***checked***, the amplitude & speed of animation are listed in the Legend

If **Animation Source** is ***checked***, the name of the ***current* Animation Source** is listed in the Legend

[Mag+Phs] Section

If **Magnitude** is ***checked***, the shape magnitude is displayed during shape animation when **Deflection | Shapes | [Mag+Phs]** is ***checked***

If **Damping** is ***checked***, the shape phase is displayed during shape animation when **Deflection | Shapes | [Mag+Phs]** is ***checked***

Compare Shapes Section

If **Sources Below** is ***selected***, both Animation Sources are displayed ***below*** the Structure **(STR)** window

If Sources on Right is *selected*, both Animation Sources are displayed on the *right side* of the Structure (STR) window

If **Show MAC** is ***checked***, the MAC value between the two shapes is displayed in the Structure **(STR)** window

If **Show SDI** is ***checked***, the SDI value between the two shapes is displayed in the Structure **(STR)** window

Colors Section

If **Left Shape** is ***checked***, the Lines on the ***left-hand*** model in the Comparison display use the color in the color box

If **Right Shape** is ***checked***, the Lines on the ***right-hand*** model in Comparison display use the color in the color box

Synchronize Rotation

If ***checked***, the **Rotational RPM** of all rotating Substructures is synchronized with the frequency of the displayed shapes during **Sinusoidal Dwell** animation.

File | Close Structure

Closes the Structure **(STR)** window.

Any window can also be closed by ***clicking*** on the close button in the ***upper right corner*** of the window.

Opening a Window

To open a Structure **(STR)** window,

- ***Double click*** on its name in either pane of the **Project Panel**
- Or ***right click*** on its name in either pane of the **Project Panel** and execute **Open** from the menu

Selecting Objects

Many operations in the Structure (**STR**) window are performed on ***selected* Objects**, or on ***all* Objects** if none are ***selected***.

An Object ***is selected*** if its **Select** button ***is depressed*** in the Objects spreadsheet.

There are several ways to ***select*** Objects of the ***current Object Type***

- ***Depress*** the **Select** button for the Object in the **Objects spreadsheet**
- Execute **Edit | Select Objects | Interactive**

Selecting All Objects

- ***Double click*** on the **Select** column heading in the Objects spreadsheet until all Select buttons are ***colored green***
- ***Right click*** on the Objects spreadsheet and execute **Select All** from the menu

Un-selecting All Objects

- ***Double click*** on the **Select** column in the Objects spreadsheet until all the **Select** buttons are ***not colored green***
- ***Right click*** on the Objects spreadsheet and execute **Select None** from the menu

Selecting a Range of Objects

- ***Un-select all Objects*** and ***click*** on the Select button of the ***first*** Object in the range to be ***selected*** in the Objects spreadsheet
- ***Hold down*** the **Shift key** and ***click*** on the **Select** button for the ***last*** Object to be ***selected*** in the Objects spreadsheet

Display Menu

Display | Center Structure Window

Centers the Structure (**STR**) window in the **Work Area** of the MEscope window

Repeated execution of this command alternately centers the window and returns it to its former position.

Display | Objects SS

Moves the **vertical blue splitter bar** horizontally to ***show*** or ***hide*** the Objects spreadsheet.

The properties of ***all* Objects** of the **current Object Type** chosen in the **Edit** menu are listed in the **Objects spreadsheet**.

Display | Structure Toolbars

Shows or Hides the Structure (**STR**) window Toolbars.

Display | View | Active View

One of the four Views of a structure model (**X View, Y View, Z view, 3D View**) is always the ***active View***.

- ***Click*** on a View to make it ***active***
- Or select a View from the **Display | View** menu

Quad View Versus Single View

Either the **Quad View** or one of the four Views **(X view, Y View, Z view, 3D View)** is always displayed in the Structure (**STR**) window graphics area.

- ***Double click*** on a single View to display the Quad View
- ***Double click*** on **one of the Views** in the Quad View to display that View alone

Display | View | Flip View

Displays the 3D model from the opposite side in the ***active*** View.

Display | View Control

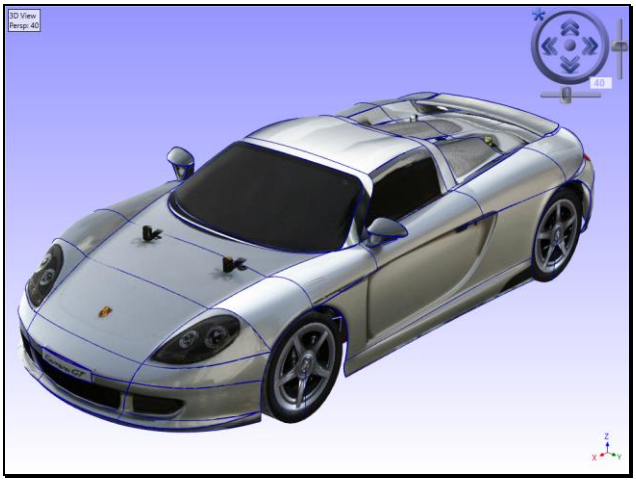
The View Control is used to,

- **Rotate** the structure model in the **3D View**
- **Zoom**, **Pan**, or change the **Perspective** distance of the structure model in the ***active*** View

When this command is executed, the **View Control** is displayed in its ***sleep state*** in the ***upper right corner*** of the ***active*** View.

- ***Move*** the mouse pointer to the ***upper right corner*** of the View to ***wake up*** the View Control, as shown below
- Each part of the **View Control** performs a different function

View Control in the Sleep State.



View Control in the Awake State.

Vectors (3D View only)

- ***Click*** on an arrow to **Rotate** the structure model

Circle (3D View only)

- ***Click & drag*** the circle ***clockwise*** or ***counterclockwise*** to Rotate the structure model

Middle Ball

- ***Click & drag*** to **Pan** the structure model

Vertical scroll bar

- ***Click & drag*** to Zoom in on the structure model

Horizontal scroll bar

- ***Click & Drag*** to change the **Perspective** distance from the structure model

Star

- ***Click*** on the star to Reset all View Control parameters to default values

Display | Points | Show Points

If ***checked***, all ***visible*** Points are displayed as ***dots*** on the structure model.

When **Points** is ***checked*** in the **Edit** menu, all ***visible*** Points are displayed on the structure model and ***all* Point properties** are listed in the **Objects** spreadsheet.

- Point Size is changed in the **Point Size** column of the **Points** spreadsheet

Display | Points | Point Labels

If ***checked***, displays the **text Label** of ***all (or selected) visible*** Points on the structure model.

Only Labels for Points with **Display Label ➔ Yes** are displayed.

Point Labels are used to create **Measured M# Links** by matching **M# DOFs** with Points & directions on a structure model.

Display | Points | Acoustic Normals

If ***checked***, displays the acoustic surface normal vector at each Point.

Display | Points | Point ICONs

If ***checked***, displays the Point **ICON** for each Point that has an ICON.

- A Point ICON is chosen in the **ICON column** of the **Points spreadsheet**.

Display | Lines | Show Lines

If ***checked***, all ***visible*** Lines are displayed on the structure model.

When **Lines** is ***checked*** in the **Edit** menu, all ***visible*** Lines are displayed on the structure model and all Line properties are listed in the **Objects** spreadsheet.

Display | Lines | Line Labels

If ***checked***, displays the **text Label** of ***all (or selected) visible*** Lines on the structure model.

- Line text Labels are entered in the **Label column** in the Lines spreadsheet

Only Labels for Lines with **Display Label ➔ Yes** are displayed.

Display | Surfaces | None

If ***checked***, Surfaces are not displayed on the model.

Display | Surfaces | Filled

If ***checked***, Surfaces are displayed and filled with their Surface color.

Display | Surfaces | Outlined

If ***checked***, Surfaces are displayed in outlined format using their Surface color.

Display | Surfaces | Texture

If ***checked***, Surface texture (including graphics) is displayed on each Surface.

Display | Surfaces | Transparent

If ***checked***, Surfaces are displayed as transparent Surfaces.

Display | Surfaces | Surface Labels

If ***checked***, Surface text Labels are displayed on the 3D model.

- Surface Labels are entered in the **Label column** on the **Objects** spreadsheet

Only Label for Surfaces with **Display Label ➔ Yes** are displayed.

Display | Surfaces | Lights

If ***checked***, lighted Surfaces are displayed on the structure model.

***See* Lights Tab** in the **File | Structure Options** section for details on surface lighting.

Display | Surfaces | Surface Normals

If ***checked***, Surface normals are displayed on the structure model.

Surface normals are used to display surfaces with lights and hidden lines.

Display | Surfaces | Reverse Normals

If ***executed***, the direction of the Surface normals of ***all*** (or ***selected***) Surfaces is reversed.

Display | Zoom In

Initiates drawing of a **Zoom Box** on the ***active* View** in the structure (**STR**) window.

After executing this command,

- ***Move*** the mouse ***pointer*** into the View where the Zoom Box is to be drawn
- The mouse pointer will change to a **cross (+)** when it enters a View
- ***Move*** the pointer to a ***corner*** of the area to be zoomed
- ***Click & drag*** to draw a **Zoom Box** on the area to be zoomed

Zooming with the Mouse Wheel

- ***Click*** on a View to make it ***active***
- ***Spin the mouse wheel*** to Zoom the display of the structure model ***in or out***

Display | Zoom Out

Restores a full display of the structure model in the ***active*** View.

Display | Re-Center All Views

Re-centers the structure model in ***all four*** Views in the Structure (**STR**) window

Display | Auto Rotate 3D View | Rotate CCW

Successive execution rotates the model ***faster*** in a ***counterclockwise*** **(CCW)** direction, or ***slower*** in a ***clockwise*** **(CW)** direction.

Display | Auto Rotate 3D View | Rotate CW

Successive execution rotates the model ***faster*** in a ***clockwise*** **(CW)** direction, or ***slower*** in a ***counterclockwise*** **(CCW)** direction.

Display | Auto Rotate 3D View | Stop

Stops auto rotation of the structure model.

Edit Menu

Edit | Undo

Restores the window to the state it was in ***before*** the ***last*** operation.

This command can be used repeatedly to undo the last **N** operations, **N = Number of edits saved.**

The Number of edits saved is changed on the **General** tab in the **Project | MEscope Options** dialog box.

Edit | Redo

Restores the window to the state it was in ***before*** the ***last execution*** of the **Edit | Undo** command.

Current Object Type

The **current Object Type** is checked in the Edit menu.

The properties of ***all*** Objects of the ***current Object Type*** are listed in the **Objects** spreadsheet.

Editing operations can only be performed on Objects of the **current Object Type**.

Edit | Select Objects | Select All

Selects all Objects of the current Object Type.

Edit | Select Objects | Invert Selection

Un-selects all selected Objects and selects all un-selected Objects.

Edit | Select Objects | Select None

Un-selects all Objects of the current Object Type.

Edit | Select Objects | Select Labeled

Selects all Objects that have **Labels**.

Labels are entered in the **Labels** column of the Objects Spreadsheet.

- ***Right click*** on the **Objects** spreadsheet and execute **Edit | Select Object | Select Labeled** to select Labeled Objects.

Edit | Select Objects | Interactive

Selects or ***un-selects*** Objects with ***geometric centers nearest to the mouse pointer*** or that ***lie within a rectangular Selection Box*** drawn in a View.

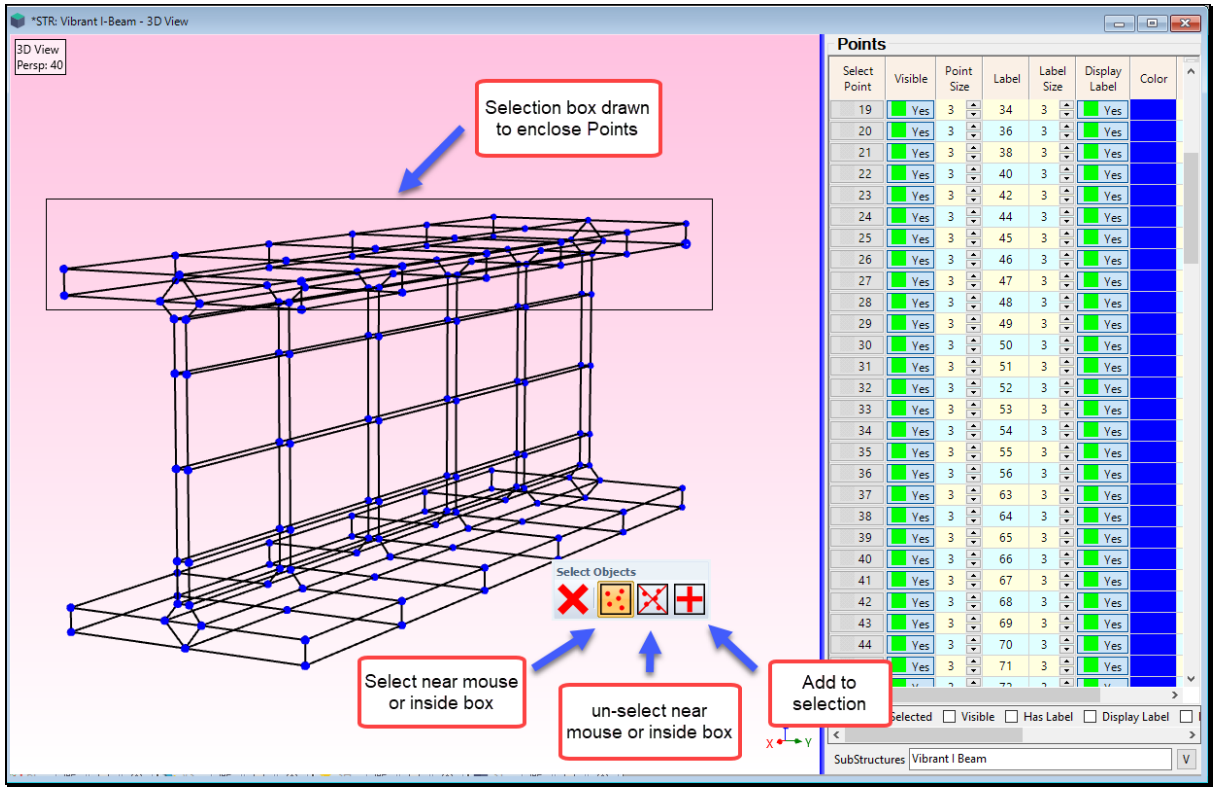
When this command is executed, a **Floating Interactive Selection Control** opens in the current View as shown below.

Using a Mouse Click

- Move the **cross pointer** near the ***geometric center*** of an Object to highlight it
- ***Click*** to ***select*** (or ***un-select***) the Object

Using a Selection Box

- Move the **cross pointer** to a corner of the desired **Selection Box**, hold down the ***left mouse button***, and ***drag*** to draw a Selection Box enclosing the desired Objects
- Release the mouse button to ***select*** (or ***un-select***) the Objects ***within*** the Selection Box



Floating Interactive Select Objects Control.

Edit | Move Up or Down

Moves ***selected*** **Objects** ***upward*** **(or** ***downward*****)** in the **Objects** spreadsheet.

Edit | Add Objects

If ***checked***, the Add Objects operation is ***enabled*** for the ***current Object Type***.

See the **Adding Points to a Model**, **Adding Lines to a Model**, **Adding Surfaces to a Model** sections for details on using this command

Edit | Sort Objects by Label

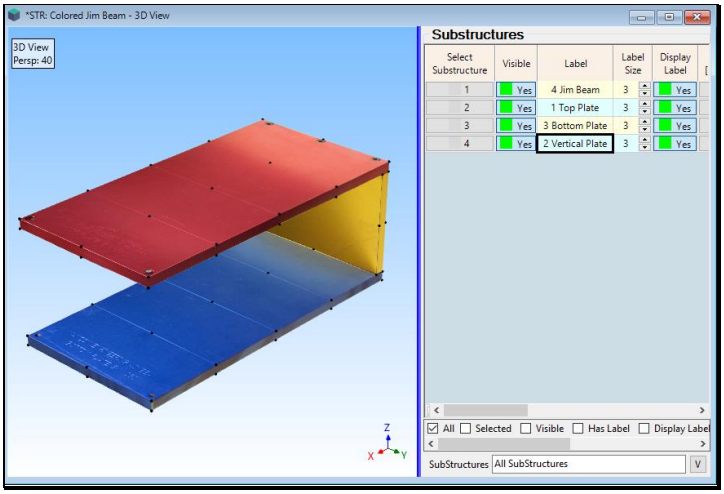
Sorts (re-orders) Objects in the rows of the ***current*** **Objects spreadsheet** according to their Labels.

Sorting ***does not change*** the structure model, or the definition of the Objects in the model.

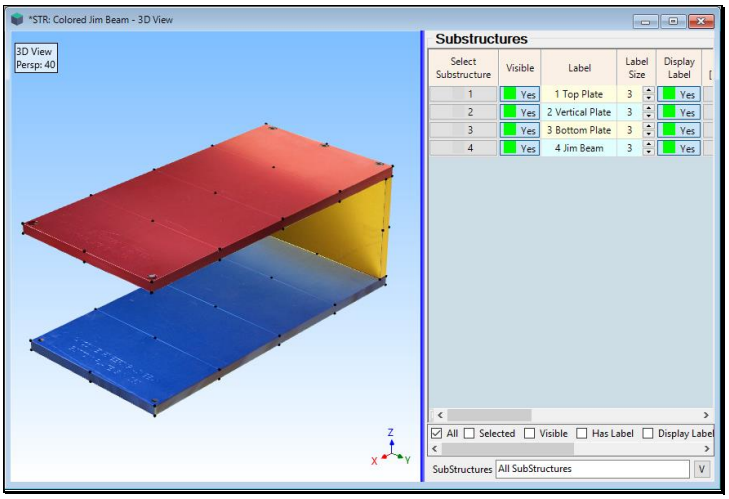
Objects are sorted in the following order

- Objects with ***numbered*** Labels
- Objects with ***non-numeric*** Labels
- Objects with ***no*** Labels

The example below shows how adding numbers in front of the Substructure names re-orders them after executing this command.



Substructures Before Sorting by Label.



Substructures After Sorting by Label.

Edit | Sort Objects by Color

Sorts (re-orders) Objects in the rows of the ***current* Objects spreadsheet** according to their Color.

Sorting ***does not change*** the structure model, or the definition of the Objects in the model.

Edit | Copy Objects to File

Copies ***all*** (or ***selected***) Objects from the structure model into another Structure (**STR**) window.

Rules for Copying Objects

- If Objects other than Points are copied, ***all Points*** referenced by the copied Objects are also copied
- If **Substructures** are copied, ***all Objects*** referenced by the copied Substructures are also copied
- ***All Objects*** are ***duplicated*** if they are ***added to the same Structure (STR) window*** as the one they are copied from

Edit | Paste Objects from File

Pastes ***all*** (or ***selected***) Objects from another Structure (**STR**) window into the ***current*** Structure (**STR**) window

Rules for Pasting Objects

- If Objects other than Points are pasted, ***all Points*** referenced by the pasted Objects are also pasted
- If **Substructures** are pasted, ***all Objects*** referenced by the pasted Substructures are also pasted
- ***All Objects*** are ***duplicated*** if they are pasted ***from the same Structure (*****STR*****) window*** as the ***current*** Structure (**STR**) window

Edit | Delete Objects

Deletes ***all selected*** Objects from the structure model.

Rules for Deleting Objects

- If a Point that ***is referenced by other Objects*** is deleted, those other Objects ***also are deleted***
- If a **Substructure** is deleted, you are given the option of also deleting the Objects referenced by the Substructure
- ***Pressing*** **the Delete key** on the keyboard is the same as executing this command

Draw Menu

Draw | Draw Structure

Terminates animation and initiates the **Drawing state** of the Structure (STR) window.

If this command is ***checked***, the Structure (**STR**) window is in the **Drawing state**.

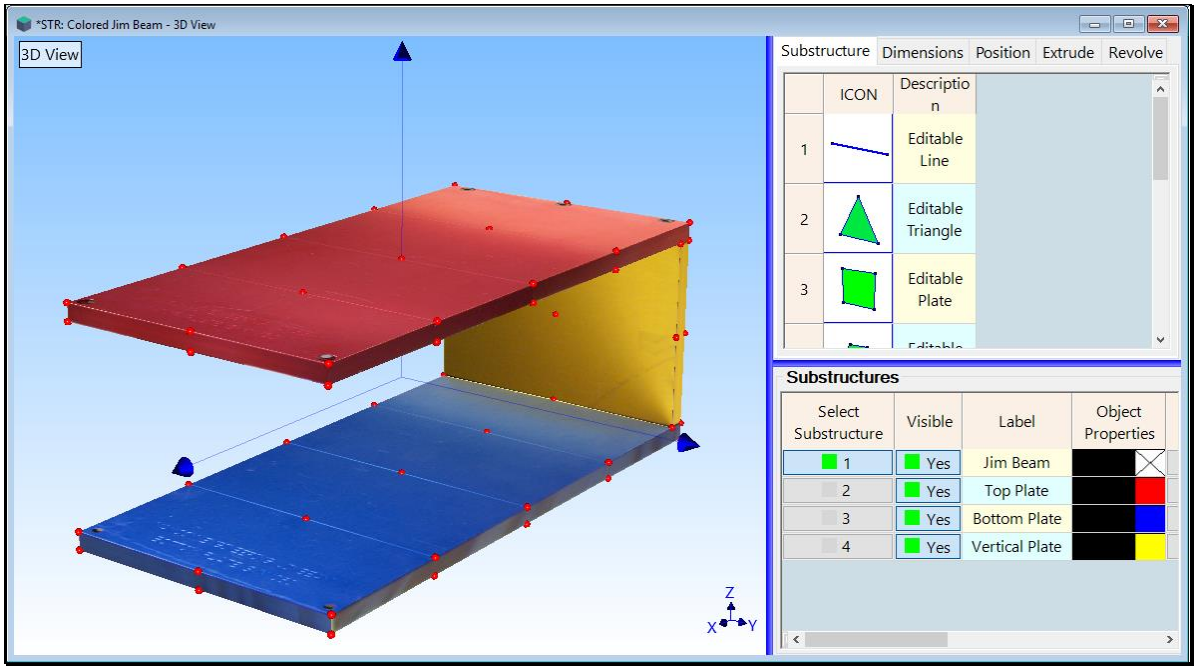
Draw | Drawing Assistant

Shows or Hides the **Drawing Assistant** tabs above the **Substructures** spreadsheet in the Structure (**STR**) window, as shown below

Using the Drawing Assistant

There are several ways to create a 3D model of a test article with the **Drawing Assistant**

- Select an ***editable*** Substructure (line, plate, cube, circle, cylinder, etc.) from the browser on the **Substructure** tab
- Select a Substructure from your **Local Models Library** in the browser on the **Substructure** tab
- **Extrude** or **Revolve** a 2D Substructure to create a 3D Substructure



*Structure (**STR**) window Showing Drawing Assistant Tabs.*

Substructure Tab

This tab contains a browser of the models in your local **Models Library.**

- ***Double click*** on a model in the browser to add it to the current drawing in the Structure (**STR**) window

Editable Substructures

The Substructures with **green surfaces** at the top of the **Models Library** browser are called ***editable*** **Substructures**.

The ***dimensions*** and ***number of points*** in each direction of an ***editable*** Substructure can be changed on the **Dimensions** tab.

Depending on its coordinate type, the dimensions of an ***editable*** *Substructure* are,

- **Rectangular:** Width, Height, Length
- **Cylindrical:** Radius, Tangential Angle, Length
- **Spherical:** Radius, Tangential Angle, Elevation Angle

Dimensions Tab

This tab is used for changing the **Length**, **Width**, & **Height** dimensions of the ***selected*** **Substructure**.

Position Tab

This tab is used for rotating the ***selected*** **Substructure** about its **Local** or **Global** (**X, Y, Z**) axes, and also to ***translate*** the **Local** origin of the ***selected*** **Substructure** with respect to the **Global** origin.

Extrude Tab

This tab is used for extruding a ***selected*** **2D Substructure** into a **3D Substructure**.

To ***extrude*** it into a 3D Substructure, the **2D Substructure *must be outlined using* Lines.**

Revolve Tab

This tab is used for ***revolving a selected*** **2D Substructure** into a 3D Substructure.

To ***revolve*** it into a 3D Substructure, the **2D Substructure *must be outlined using* Lines.**

Draw | Points | Number Points

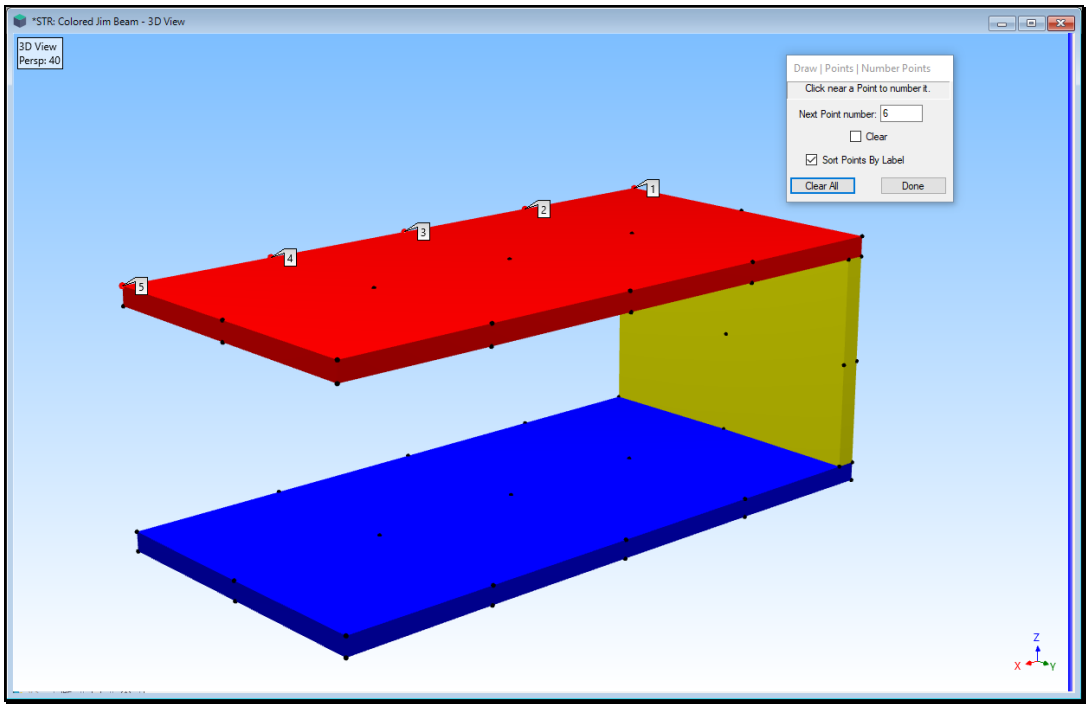
Used to ***number*** the Points on a structure model by ***clicking near each Point.***

Test Points ***must be numbered*** before using the **Match Structure and Source DOFs** option in the **M# Links | Measured Links** command dialog box.

When this command is executed, the floating **Number Points** dialog box is opened, as shown below

- ***Click near*** a Point to number it with the **Next Point number** in the dialog box
  - Each time a Point is numbered, the **Next Point number** is increased by **"1"** in the dialog box
- ***Check*** the **Clear** box and ***click near*** the Point to ***clear*** its Label
- To ***clear all*** Point Labels**, *click*** on **Clear All**

Point Numbers can also be ***manually entered*** into the **Label** column the **Points** spreadsheet



3D View During Point Numbering.

Draw | Points | Add Point to Line

Adds a new Point to a Line. The original Line is replaced with two new Lines.

- ***Click near*** a Line to ***select*** *it* and add a Point to the ***selected*** Line
- To ***re-position*** the new Point along the Line,
  - Before releasing the mouse button**, *drag*** the new Point to its desired position on the Line

Draw | Points | Add Point to Surface

Adds a new Point to a Surface Triangle or Surface Quad. The original Surface is replaced by new Surfaces.

- ***Click near*** a Surface to ***select*** it and add a Point to the ***selected*** Surface
- To ***re-position*** the new Point on the Surface,
  - Before releasing the mouse button, drag the new Point to its desired position on the Surface

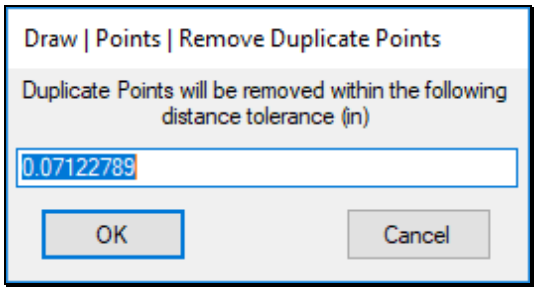
Draw | Points | Remove Duplicate Points

Removes all duplicate Points from the structure model.

This command is useful for ***reducing the number of*** **Points** in large complex models with closely spaced Points in them.

When this command is executed, the following dialog box is opened

- Enter a distance tolerance for removing duplicate Points and click on OK

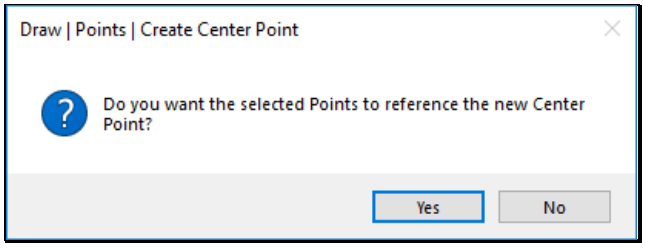


Draw | Points | Create Center Point

Creates a new Center Point at the ***geometric center*** of all ***selected*** **Points**, and adds it to the **Points** spreadsheet.

If this command is used with a ***selected*** **Substructure**, the coordinates of the Center Point are calculated as the ***geometric center*** of all Points referenced by the ***selected*** **Substructure**

When this command is executed, the following dialog box will open,



If you ***click*** **on Yes**, the new Point ***will be added*** to the **Center Point** column of the ***selected*** **Points,** turning them into **Radial Points** that reference the new **Center Point.**

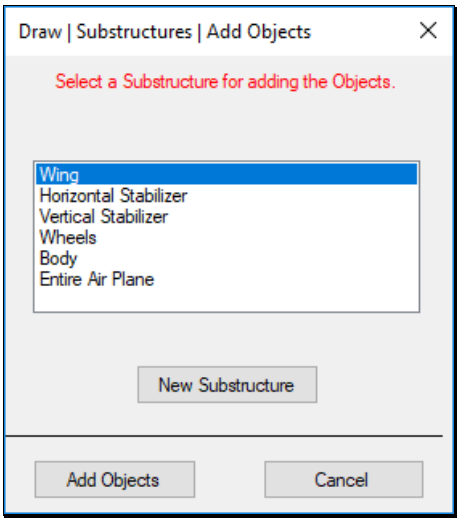
If you ***click*** **on No**, the new Point ***will not be added*** to the **Center Point** column of the ***selected*** **Points**.

Draw | Substructures | Add Objects to Substructure

Creates a new Substructure, or adds ***selected Objects*** to an existing Substructure.

- If Objects ***other than Points*** are ***selected***, the end Points referenced by the Objects are also added to the Substructure
- If a **Substructure** is ***selected***, ***all Objects*** referenced by the Substructure are added to the new Substructure

When this command is executed, the following dialog box will open



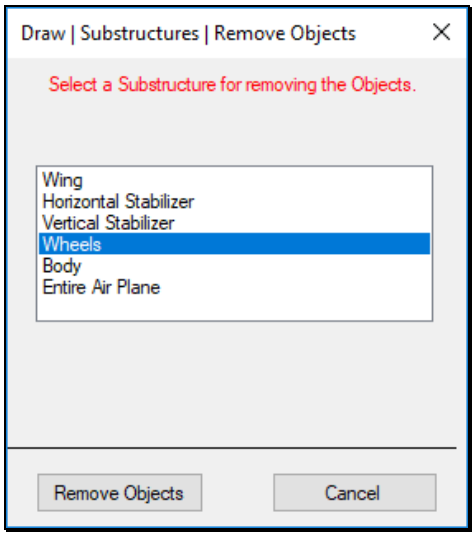
- Choose an existing Substructure and ***click* on Add Objects**
- Or ***click*** on **New Substructure** to create a new substructure that references the selected Objects.

Draw | Substructures | Remove Objects from Substructure

Removes ***selected Objects*** from an existing Substructure on the 3D model.

- Objects referenced by the Substructure ***are not removed from the 3D model*** when this command is executed

When this command is executed, the following dialog box will open

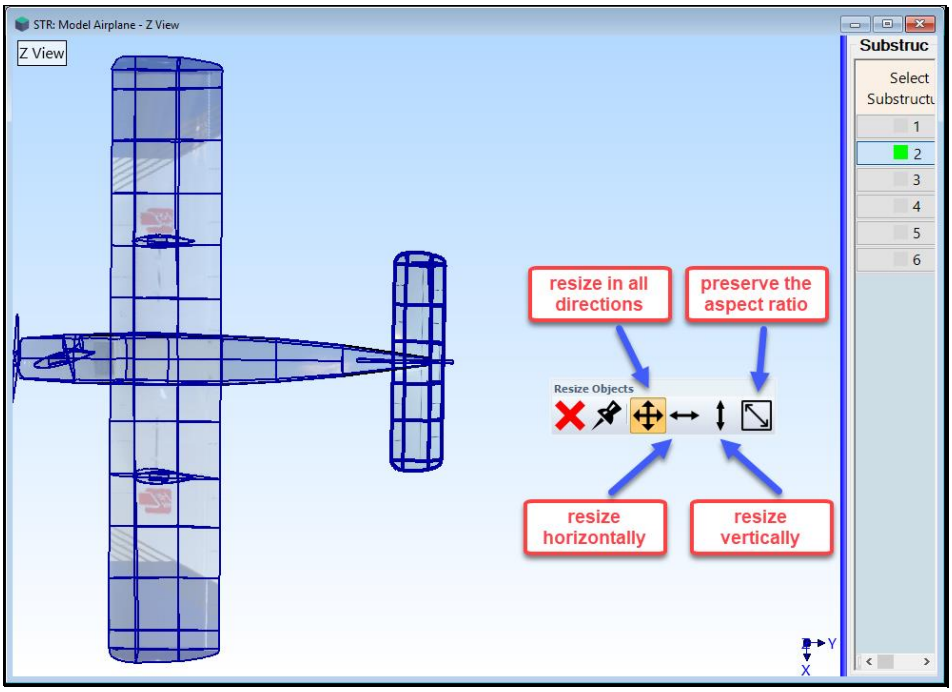


- Choose an existing Substructure from which to remove the ***selected*** Objects, and ***click*** on **Remove Objects**

Draw | Resize Objects

Changes the size or shape of ***selected*** Objects.

When this command is executed, the **Resize Objects** floating control box is displayed, as show below



Resize Objects Floating Control.

The mouse pointer will change to a ***Resize pointer*** when it enters a View

- Choose a direction to resize in the ***Resize Objects Floating Control***
- ***Click & drag*** to resize the selected Objects

Resizing Point ICONs

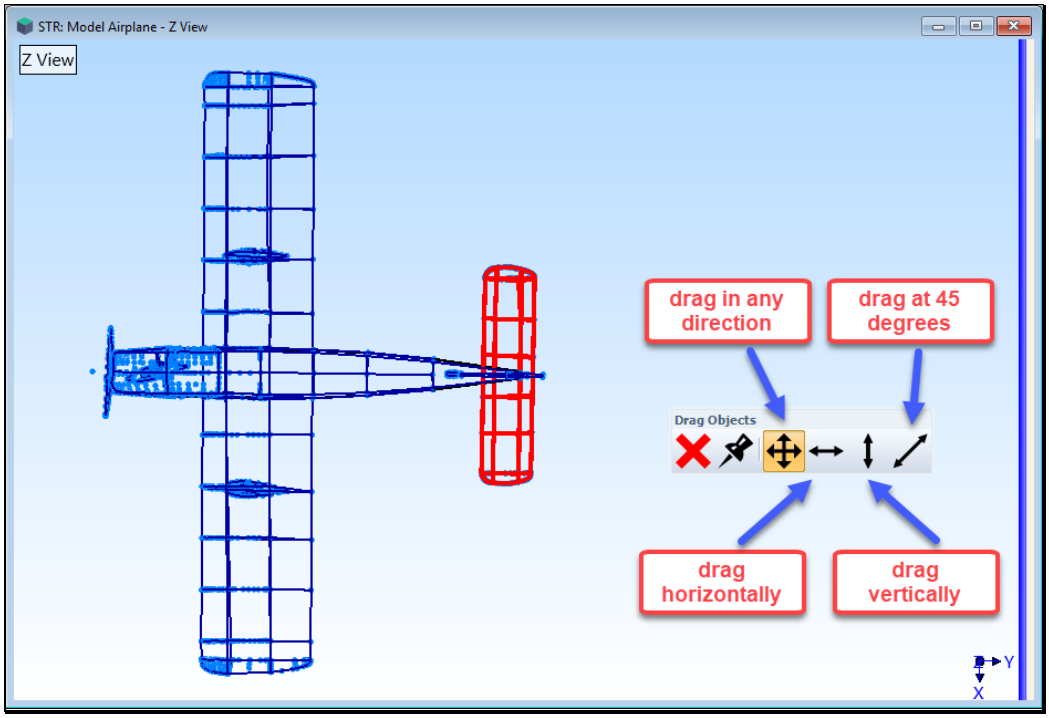
- Select Points with ICONs assigned to them in the **ICON** column of the **Points** spreadsheet
- Execute **Draw | Resize Objects** and ***click* on Yes** in the dialog box that opens

Draw | Drag Objects

Changes the position of ***selected*** Objects.

When this command is executed, the **Drag Objects** floating control box is displayed, as show below

- The mouse pointer will change to a ***Drag pointer*** when it enters a View
- ***Click & drag*** to drag the ***selected*** Objects



Drag Objects Floating Control.

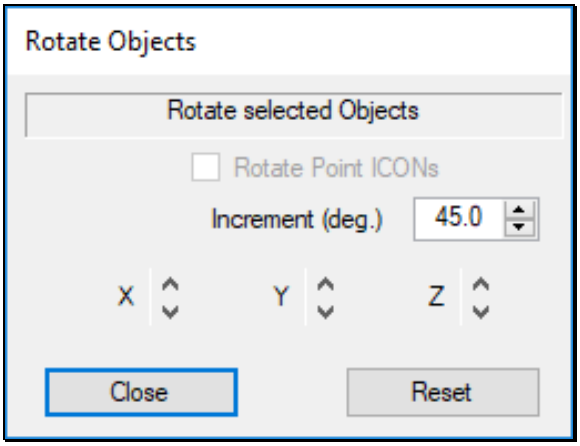
Draw | Rotate Objects

Rotates ***selected*** Objects about the global (**X, Y, Z**) axes.

When Objects are rotated, their **Point *coordinates are changed*** in the **Points** spreadsheet.

When this command is executed, the **Rotate Objects** dialog box is displayed, as show below

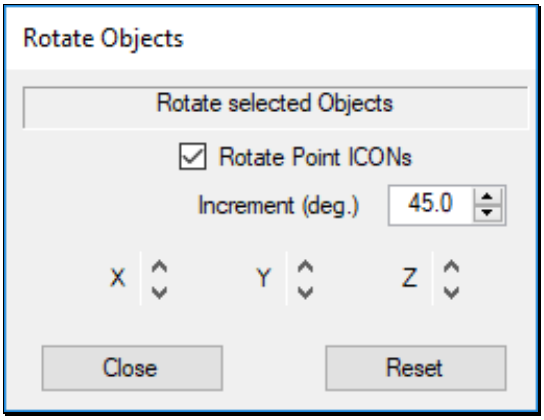
- Enter the rotational Increment (in degrees)
- ***Click*** on one of the **Up/Down** Vectors next to the axis about which to rotate the selected Objects



Rotate Selected Objects Dialog Box.

Rotating Point ICONs

- Select Points with ICONs assigned to them in the **ICON** column of the **Points** spreadsheet
- ***Check* the Rotate Point ICONs** box
- Click on the Up/Down Vectors next to the axis about which to ***rotate the* ICON *of each selected* Point**



Rotate Point ICONs of Selected Points.

Draw | Mesh Objects Menu

The commands in this menu are used to mesh (subdivide) ***all*** (**or *selected***) ***Objects*** on a structure model.

All ***selected*** Objects ***are replaced by new*** **Objects** of the same type.

The following types of Objects can be meshed,

Line Objects: Lines (FEA Springs, FEA Dampers, FEA Rods, FEA Bars*)

Triangle Objects: Surface Triangles (FEA Triangle Plates*)

Quad Objects: Quad Surfaces (FEA Quad Plates*)

Substructures: All Line, Triangle, and Quad Objects referenced by a Substructure

* ➔ only with the **VES-5000** & **VES-8000** options

Draw | Mesh Objects | Mesh All Edges

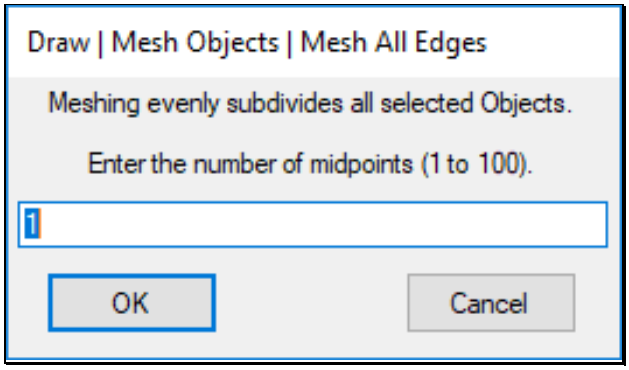
Subdivides the edges of ***all*** (or ***selected***) Objects using ***evenly spaced*** midpoints.

The term **"edge"** refers to either a **Line Object** or the edge of a **Triangle** or **Quad Object**

Meshing a **Line** divides it into ***equal Line segments***

Meshing a Triangle or Quad Object ***evenly subdivides each of its edges***.

When this command is executed, the following dialog box will open

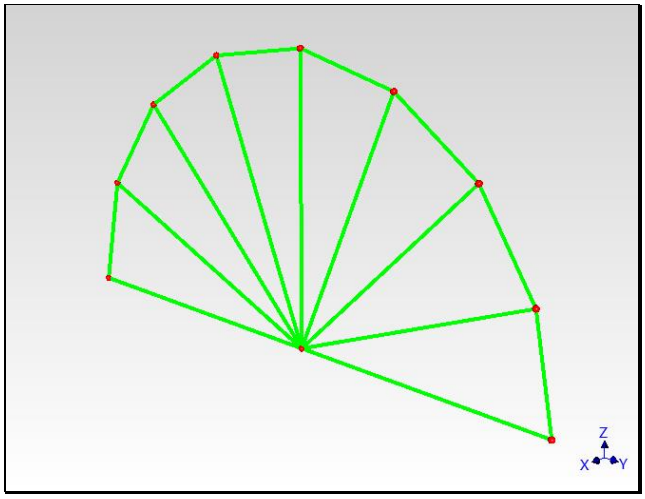


The **number of midpoints** is the number of Points that will be added between the endpoints of each Line or Surface edge.

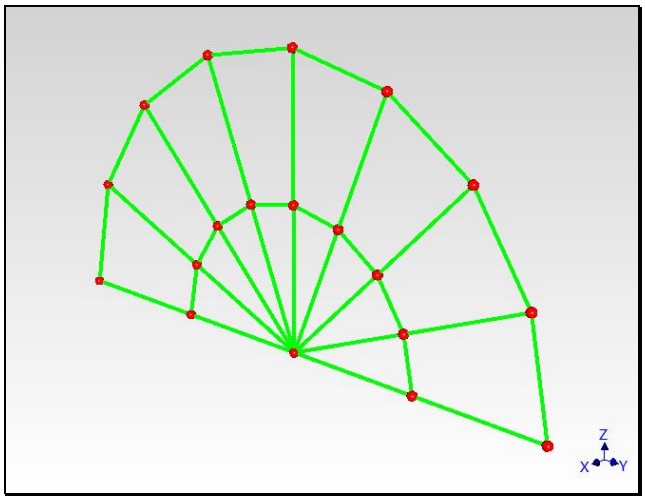
Draw | Mesh Objects | Mesh Longest Edges

Meshes only the **"longest edges"** of ***all*** (or ***selected***) Objects.

Edges are meshed so that no edge is longer than half of the longest edge found among all selected Objects.



Surfaces Before Meshing Longest Edges.



Surfaces After Meshing Longest Edges.

Meshing Substructures

To ensure that ***all Line & Surface Objects*** are properly meshed, it is better to create a new Substructure with ***all Line & Surface Objects*** in it and mesh the Substructure.

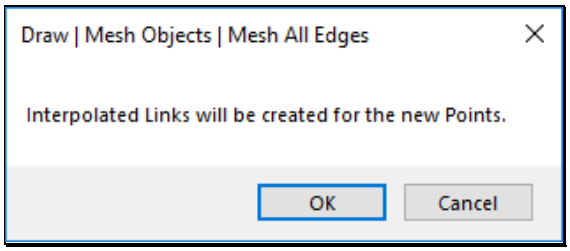
- ***Select*** the Objects to be meshed and Execute **Draw | Substructures | Add Objects**
- ***Click*** on **New Substructure** in the dialog box and enter a name for the new Substructure
- ***Select*** the new Substructure and mesh it

Creating Interpolated M# Links During Meshing

If all Points referenced by the meshed Objects already have **Measured M# Links**, **Interpolated M#s Links** will be created for all new Points created by meshing.

This allows you to start with a ***simple*** (stick or surface) model with only a ***few*** **Linked M#s**, and create a meshed model with many more Points, including their **M# Links**.

If **M# Links** are already created for the Points on the Objects to be meshed, the following dialog will open informing you that **M# Links** will be created for all new Points.



M# Links Menu

M# Links are used to link **M#s** in an Animation Source (**BLK**, **SHP, ACQ** window) to Points & directions on the 3D model in an **STR** window

- Each **M# Link** contains the M#s used to fetch data from the Animation Source during shape animation
- All **M# Links** are saved with the Structure (STR) window when it is saved in the current Project file

Measured Link

Each ***measured*** DOF (Point & direction) on a structure model is animated by evaluating its **Measured Link**.

- **Measured Links** are created for ***all*** (or ***selected***) **Points** by executing **M# Links | Create Measured Links**

Interpolated Link

Each ***un-measured*** DOF (that is not a Fixed DOF) is animated by evaluating its **Interpolated Link**.

- **Interpolated Links** are created for ***all*** (or ***selected***) **Points** by executing **M# Links | Create Interpolated Links**

Interpolated Links are created from the **Measured Links & Fixed DOFs** of ***nearby Points***.

Fixed DOF

A DOF on the 3D model that has been fixed will not move during animation.

- Fixed DOFs are created for ***all*** (or ***selected***) **Points** by executing **M# Links | Fix Directions**

M# Links | Measurement Axes

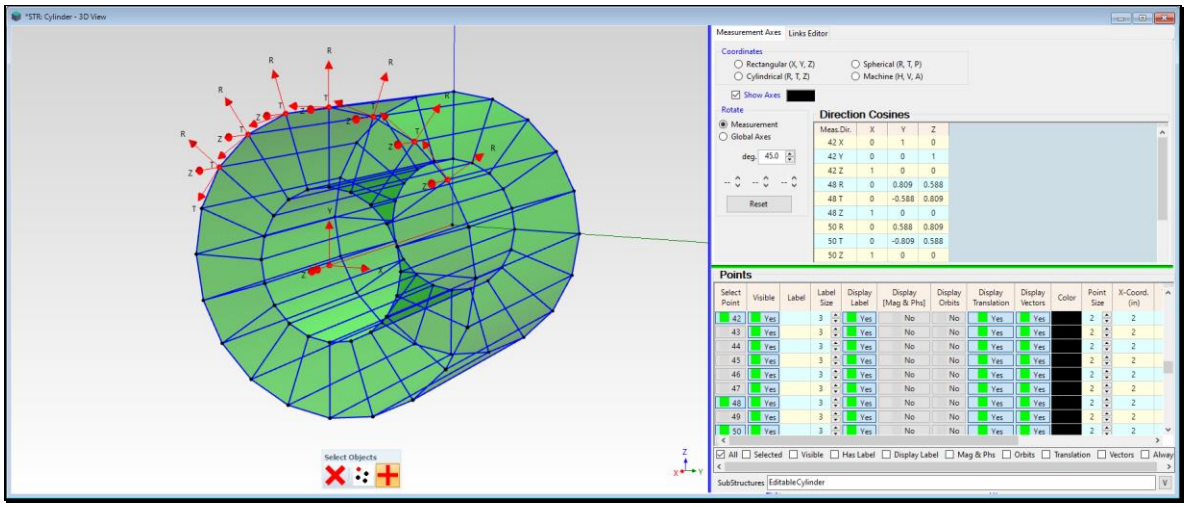
Opens and closes the **Measurement Axes** tab, as shown below.

The Measurement Axes at each test Point define the directions of the sensors at that Point.

Measurement Axes allow you to mount each sensor in the most convenient direction at each test Point.

To display the Measurement Axes at a Point,

- ***Check*** **Show Axes** on the Measurement Axes tab, and ***select*** Points to display their Measurement Axes



Structure Showing Cylindrical Measurement Axes.

The Measurement Axes at each Point can be labeled as rectangular, cylindrical, spherical or machine coordinates.

Different symbols are used to label each axis, according to the table below.

Measurement Axes	Axes Symbols
Rectangular	**X**, **Y**, **Z**
Cylindrical	**R** (radial), **T** (tangential), **Z** (axial)
Spherical	**R** (radial), **T** (tangential), **P** (elevation)
Machine	**H** (horizontal), **V** (vertical), **A** (axial)

Rotating the Measurement Axes

- ***Press*** one of the **Rotate** Vectors to rotate the Measurement Axes of ***all selected Points*** about a **Measurement** or **Global** axis

Increment (deg.)

The amount of rotational increment (in degrees) that the Measurement Axes will rotate each time an **Up/Down rotation arrow** is ***pressed***.

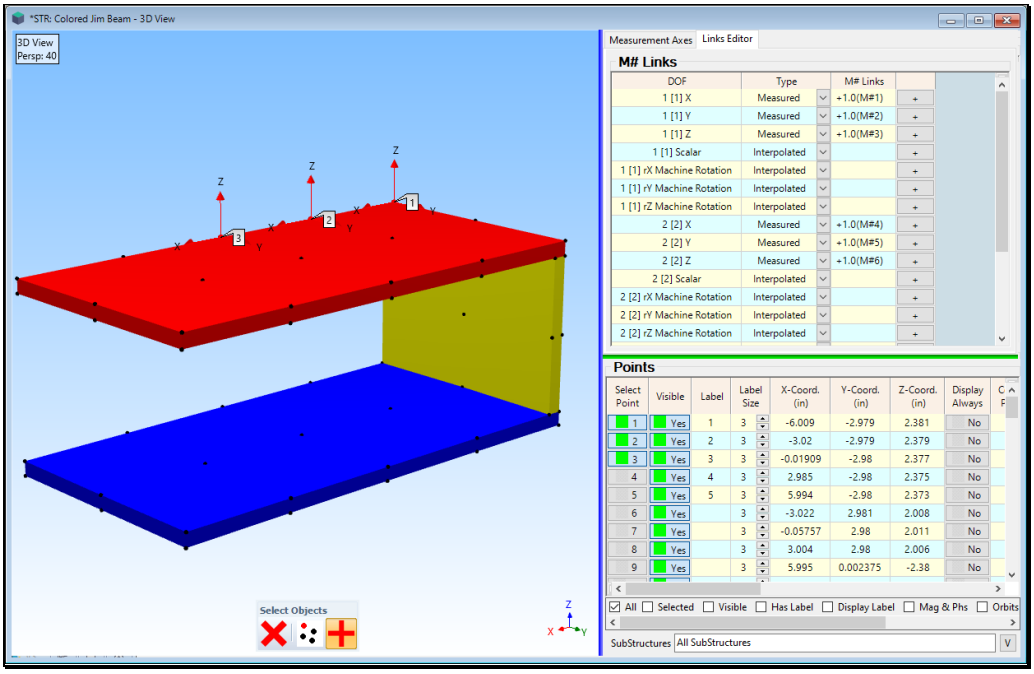
Reset button

Returns the **Measurement Axes** to their default positions.

M# Links | Links Editor

Opens and closes the **M# Links Editor** tab, as shown below.

- The ***current M# Links*** at each **selected Point** are displayed on this tab



***M# Links** Editor Tab.*

Each **M# Link** is used to retrieve data from the ***current* Animation Source**
Each **time or frequency measurement function** in a Data Block (**BLK**) or Acquisition (**ACQ**) wido has a ***unique* M#**
Each **shape DOF** in a Shape Table (**SHP**) has a ***unique* M#**

Translation Link

Links translational data (***vibration*** and ***acoustic intensity***) to a DOF on the 3D model.

Up to ***three* Translation Links** can be created for each Measurement Axis direction at a Point

Scalar Link

Links ***scalar*** data to a Point on a 3D model.

Scalar data is typically animated using **color contours** on a surface model.
Sound pressure level (SPL), sound power, temperature & pressure are examples of **scalar** data.

Machine Rotation Link

Links ***Machine Rotation*** data to to a DOF on the 3D model.

Machine rotational data is typically measured from a rotating shaft

A **Machine Rotation Link** is typically created in the **Z-direction** at each **Center Point** of a **rotational Substructure**.

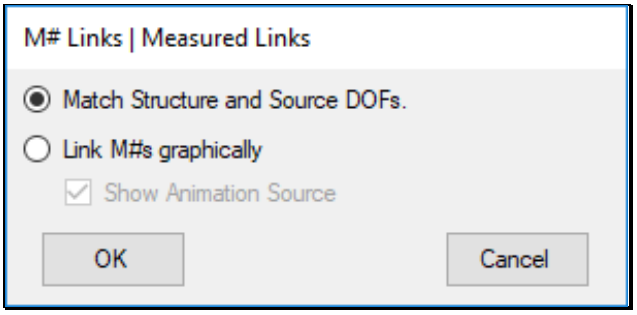
Machine rotational data is animated by displaying the ***rigid body rotation*** of all **Radial Points** about a referenced **Center Point.**

M# Links | Create Measured Links

Creates **Measured M# Links** for ***all*** (or ***selected***) Points on the structure model.

Measured Links *must be created* before shape data can be displayed in animation from a Data Block (**BLK**), Acquisition (**ACQ**), or Shape Table (**SHP**)

When this command is executed, the following dialog box will open, giving a choice of ***two methods for creating*** **Measured Links**.



Match Structure and Source DOFs

Before selecting this method, three conditions are required,

1. Each test Point on the structure model must be ***numbered*** (**1**, **2**, **3**, etc.)
2. The **Measurement Axes** at each test Point must be oriented to coincide with the sensor directions for that Point
3. The **Roving DOF** of ***all*** (or ***selected***) **M#s** in the ***current*** **Animation Source** must contain Point numbers that match numbered Points on the structure model, and directions that match the direction of the **Measurement Axes**

Measurement Axes

The **Measurement Axes** at each test Point can be defined as Rectangular (**X, Y, Z**), Cylindrical (**R, T, Z**) , Spherical (**R, T, P**), or Machine (**H, V, A**).

The **Measurement Axes *directions*** must coincide with the ***actual directions of measurement*** at each test Point.

The **Measurement Axes *directions must match a direction*** in the **Roving DOF** of the **M#** that contains data which was acquired at that Point.

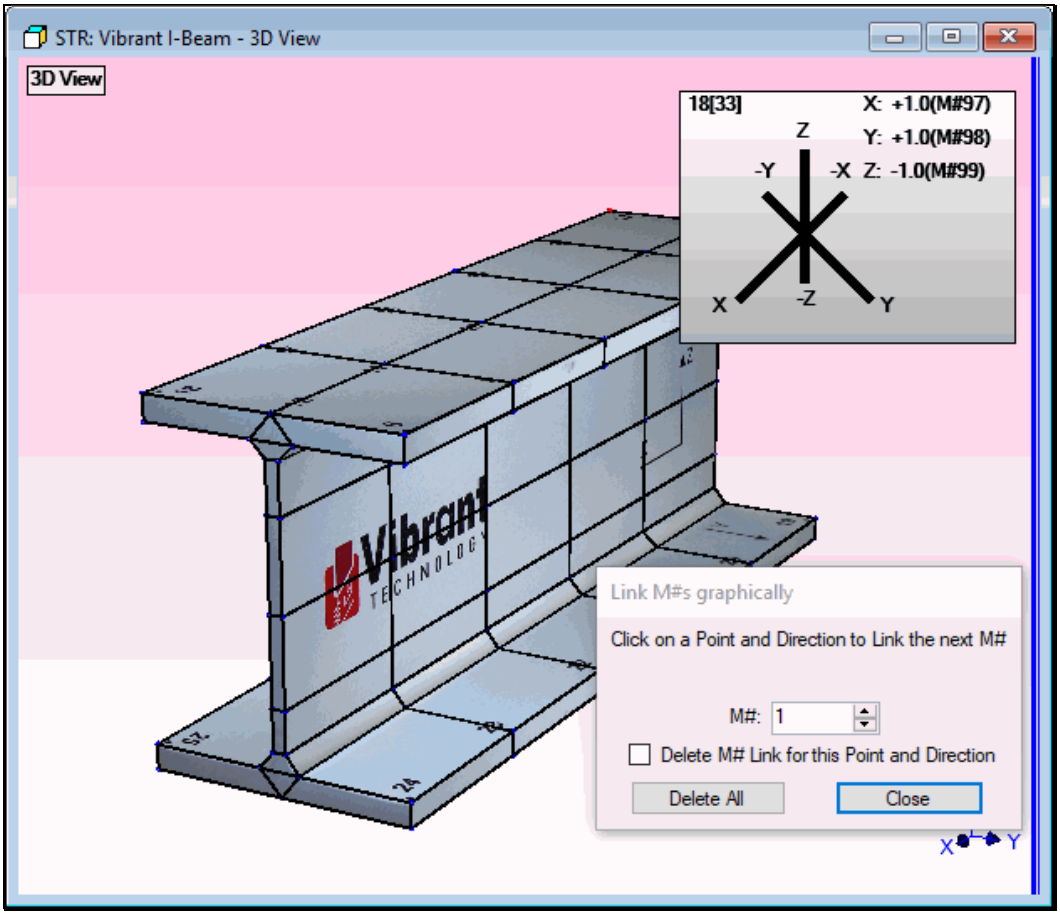
Measured Link Creation

The type of **M# Link** created depends on the **Data Type** of the **M#** in the ***current*** **Animation Source**

- A **Translation M# Link** is created for each ***Point & direction*** that matches the **Roving DOF** of an **M#** with **Translation** Data Type
- A **Scalar M# Link** is created for each ***Point & direction*** that matches the **Roving DOF** of an **M#** with **Scalar** Data Type
- A **Machine Rotation M# Link** is created for each ***Point & direction*** that matches the Roving DOF of an **M#** with **Machine Rotation** Data Type

Link M#s Graphically

When this method is chosen, a dialog box is opened in the Structure (**STR**) window, as shown below



Make sure the **M#** box contains the number of the **next M#** in the current Animation Source to be linked to a direction of the structure model

- ***Click*** on a Point to ***select it***

The Measurement Axes of the Point will be displayed in a separate dialog box, as shown above

- ***Click*** **on one of the Measurement Axes** in the dialog box to create a Link for the selected direction
  - If you select a wrong direction, check **Delete Link** for this Point & Direction and click on the wrong direction to clear its link

M# Links | Create Interpolated Links

Creates Interpolated Links for the DOFs of ***all*** (or ***selected***) Points ***that don't have*** Measured Links or are Fixed.

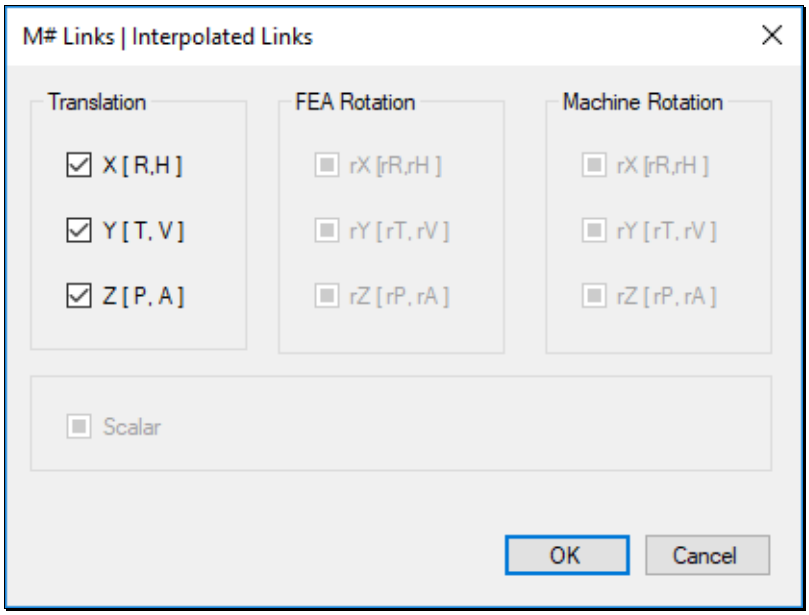
Interpolated Links provide animation for all ***un-measured*** DOFs on the structure model.

Each Interpolated Link is a ***weighted summation*** of the **M#** Links of ***neighboring Measured DOFs*** and include the ***influence of Fixed DOFs***

Hint: It is a good practice to ***select Points*** and create **Interpolated Links** for ***portions of the model at a time***, then Animate a Shape to verify that the **Interpolated Links** provide realistic animation.

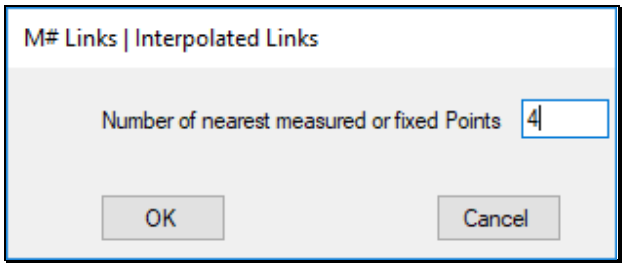
When this command is executed, the dialog box shown below is opened

- ***Check*** the axis directions for creating **Interpolated Links** and ***click*** **on OK**



Measurement Axes	Axes Symbols
Rectangular	**X**, **Y**, **Z**
Cylindrical	**R** (radial), **T** (tangential), **Z** (axial)
Spherical	**R** (radial), **T** (tangential), **P** (elevation)
Machine	**H** (horizontal), **V** (vertical), **A** (axial)

In the next dialog box, choose the ***maximum number*** of ***nearest Measured & Fixed DOFs*** to be used when creating each **Interpolated Link**



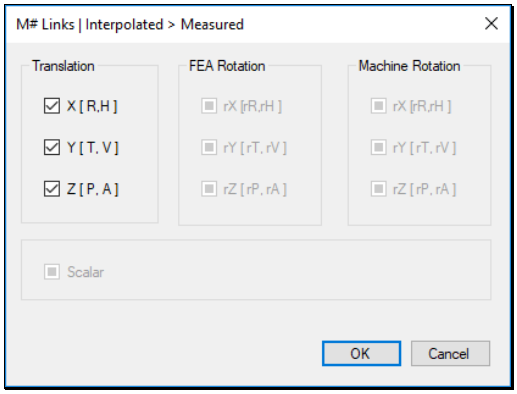
M# Links | Interpolated > Measured

Converts Interpolated Links to Measured Links for all (or selected) Points.

Measured Links are ***always required*** for shape animation.

Converting **Interpolated Links** to **Measured Links** makes them available for creating **Interpolated Links** for other Points on a model that are un-measured.

When this command is executed, the dialog box shown below is opened



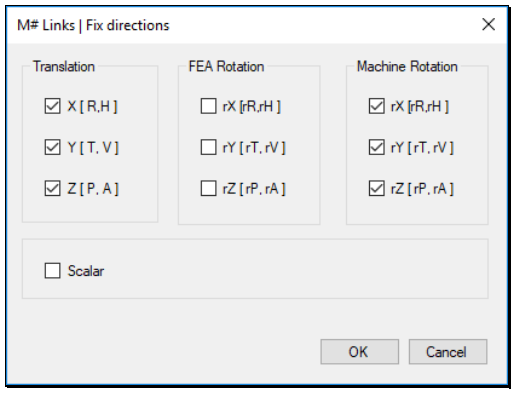
- ***Check*** the Measurement Axes directions for converting the Interpolated Links and ***click*** on OK

M# Links | Fix directions

This command is used to fix directions for ***all* (or *selected*) Points** so that no motion will occur in those directions during shape animation.

When this command is executed, the dialog box shown below is opened.

- *Check* the Measurement Axes directions to be fixed and ***click* on OK**

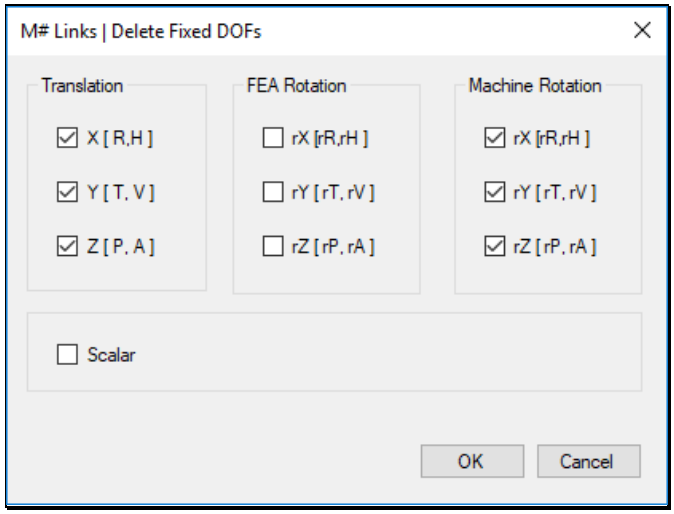


M# Links | Delete Fixed DOFs

Converts Fixed to ***un-linked directions*** **for** ***all*** **(or** ***selected*****)** Points.

When this command is executed, the dialog box shown below is opened.

- ***Check*** the Measurement Axes directions for converting Fixed to ***un-linked directions*** and ***click*** **on OK**

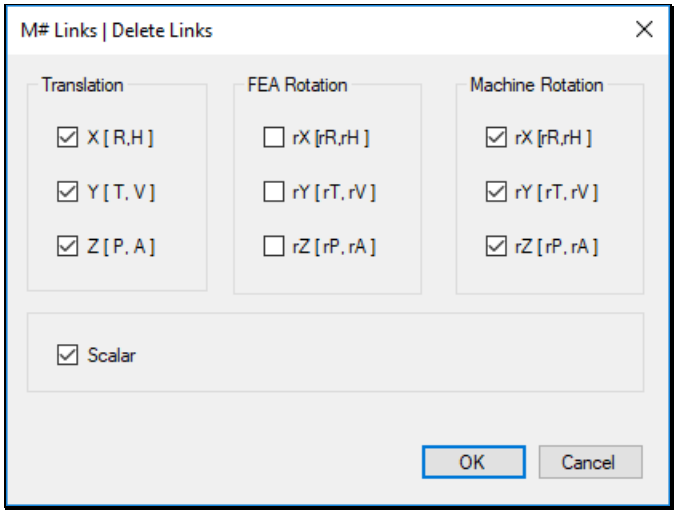


M# Links | Delete Links

Deletes the Measured and Interpolated M# Links for ***all*** **(or** ***selected*****)** Points.

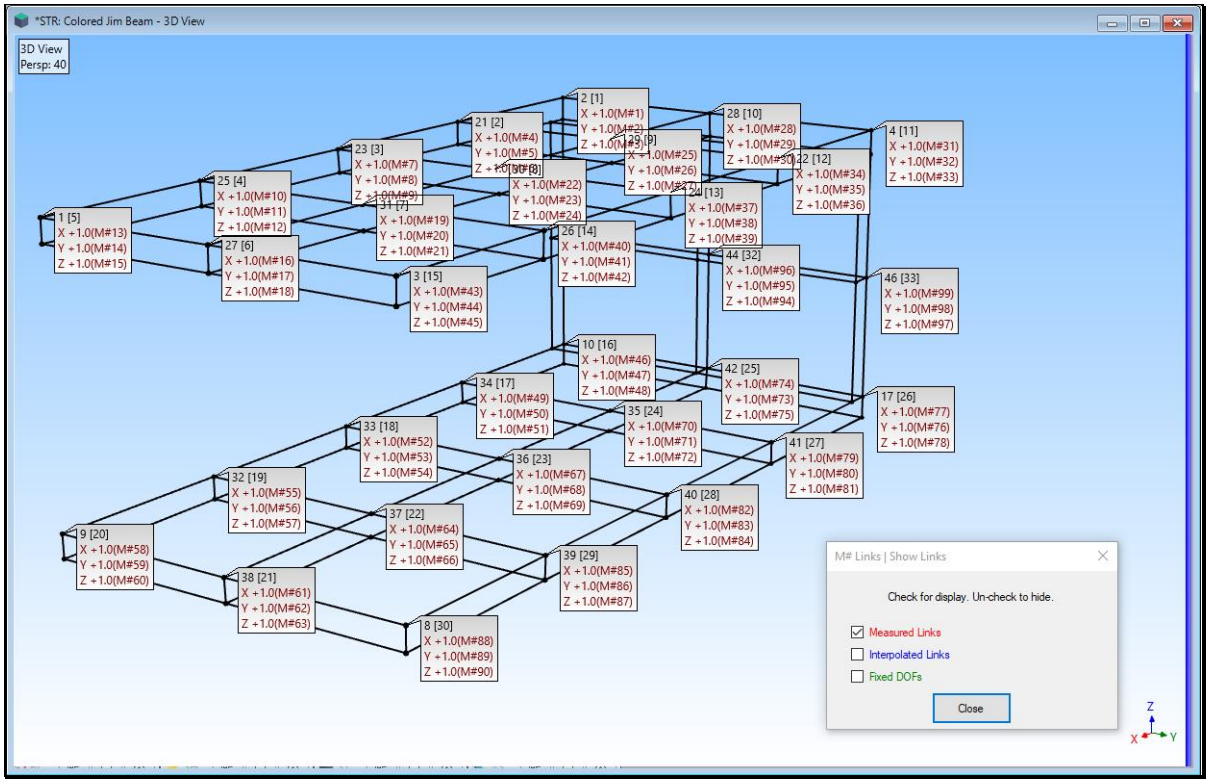
When this command is executed, the dialog box shown below is opened.

- ***Select*** the Measurement Axes directions for deleting **M#** Links and *click* on OK



M# Links | Show M# Links

When this command is executed, a dialog box is opened giving a choice of the type of **M# Links** to display on the 3D model.



Measured M# Links Displayed on the Model

Measured Links

If ***checked***, Measured Links are displayed at ***all*** (or ***selecte***d) Points.

- **Measured Link** directions are indicated with **Red Vectors**

Interpolated Links

If ***checked***, Interpolated Links are displayed at ***all*** (or ***selecte***d) Points.

- **Interpolated Link** directions are indicated with **Blue Vectors**

Fixed DOFs

If ***checked***, Fixed directions are displayed at ***all*** (or ***selecte***d) Points.

- **Fixed** directions are indicated with **Green Vectors**

M# Links | Select M#s

Selects measurements (**M#s**) in the ***current*** **Animation Source** using the **M# Links** of at ***all*** (or ***selecte***d) Points on the structure model.

When this command is executed, the ***current*** **Animation Source** window is opened and ***selected*** **M#s** are displayed in the **M#s** spreadsheet.

M# Links | Select Source M#s

Uses the **M# Links** to select the **M#s** in the ***current*** **Animation Source.**

M# Links | Update Source Roving DOFs

Uses the **M# Links** to update the **Roving DOFs** of **M#s** in the ***current*** **Animation Source.**

M# Links | Expand Source M#s

Uses the **M# Links** to create a new **BLK** or **SHP** file using the **linked M#**s in the ***current*** **Animation Source.**

Animate Menu

Animate | Animate a Shape

If ***checked***, the Structure (**STR**) window is in the **Animation state**.

When **Animate | Animate a Shape** is ***checked***, shapes from a ***single*** **Animation Source** are displayed in animation on the structure model.

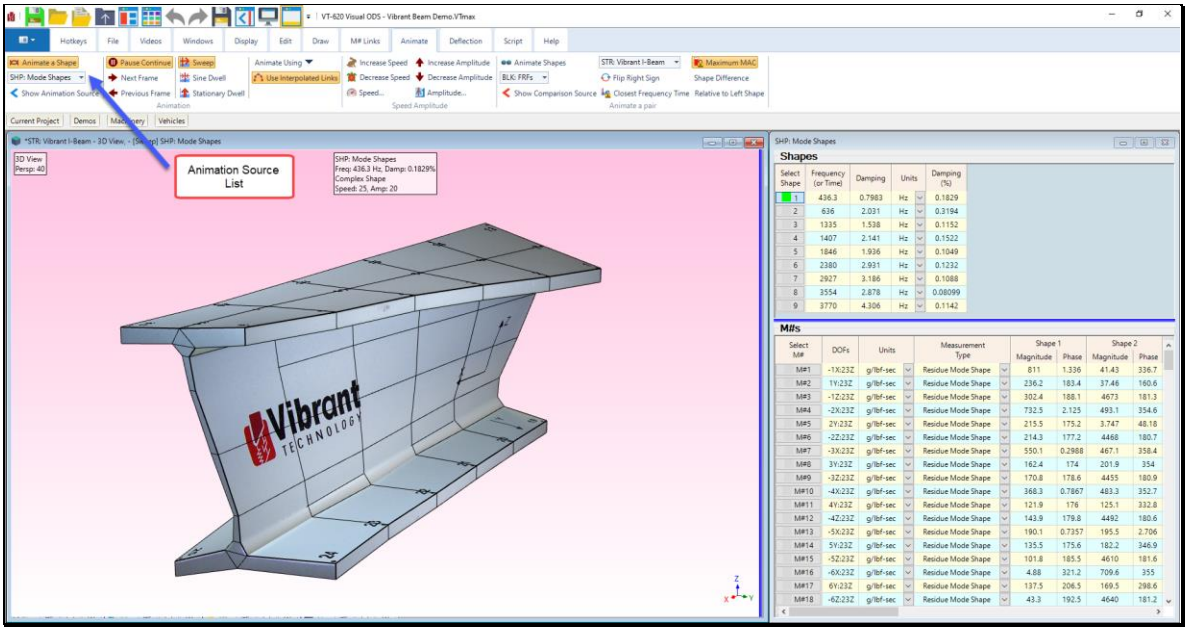
The ***current*** **Animation Source** can be a Data Block (**BLK**), Shape Table (**SHP**), or Acquisition (**ACQ**) window.

The ***current*** **Animation Source** is displayed in the **Animation Source list** on the Structure (**STR**) window Toolbar.

Requirements for Animation

The structure model must have **M# Links** at ***one or more*** Points.

An **Animation Source** window, (Data Block (**BLK**), Shape Table (**SHP**), or Acquisition (**ACQ**) must be open in the **Work Area**.



Animation Source List.

Animate | Show Animation Source

Displays the ***current*** **Animation Source** window ***on the right side*** of the Structure (**STR**) window.

The ***current*** **Animation Source** is listed in the **Animation Source** list on the Structure (**STR**) window Toolbar or Ribbon, as shown above.

Animation from a Data Block (BLK) or Acquisition (ACQ)

If **Animate | Sweep** is ***checked*** the cursor is swept through the Data Block (**BLK**) or Acquisition (**ACQ**) window and the **M# values** at the cursor position are displayed as the shape.

If **Animate | Sine Dwell** is ***checked***, **M#** values at the cursor position are displayed as the shape using sine wave values ranging between -1 & +1.

If **Animate | Stationary Dwell** is ***checked***, **M#** values at the cursor position are displayed as the shape without modulation.

Animation from a Shape Table (SHP)

If **Animate | Sweep** is ***checked***, each shape in displayed in **Sine Dwell** animation, followed by the next shape in the Shape Table (**SHP**).

The number of **Sine Dwell Cycles per Shape** is defined in the Shape Table (**SHP**) Options box.

If **Animate | Sine Dwell** is ***checked***, **M# values** for the ***selected*** Shape are displayed as the shape using sine wave values ranging between **-1** & **+1**.

If **Animate | Stationary Dwell** is ***checked***, **M# values** of the ***selected*** Shape are displayed as the shape without sine modulation.

Which Shape Data is Displayed?

If **Display | M#s | Real** is ***checked***, the **Real** part of the **M#** data is animated on the structure modal as the shape.

If **Display | M#s | Imaginary** is ***checked***, the **Imaginary** part of the **M#** data is animated on the structure modal as the shape.

Otherwise, the **Magnitude & Phase** of the **M#** data is animated on the structure modal as the shape.

Changing the Current Animation Source

- During animation, ***click*** on any Data Block (**BLK**), Shape Table (**SHP**) or Acquisition (**ACQ**) window to and it will become the ***current*** **Animation Source**.
- Or choose another Animation Source from the **Animation Source list** on the Toolbar.

Selected M#s

If **M#s** are ***selected*** in the Animation Source, only shape data for the ***selected*** **M#s** is displayed during shape animation.

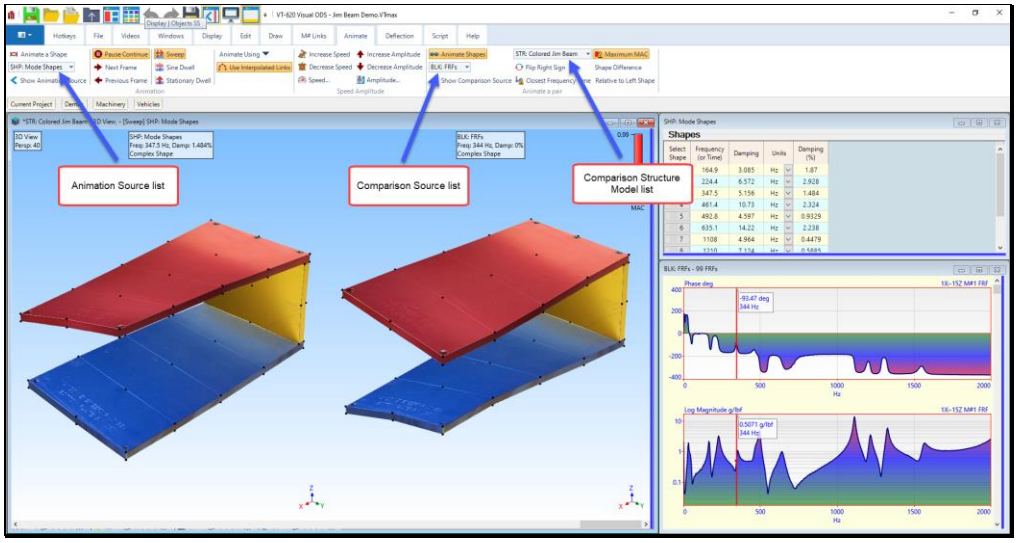
Animate | Animate a Pair Menu

The commands in this menu are used to display two shapes side-by-side in animation from ***two different Animation Sources***.

To use these commands, ***two or more*** **Animation Source** windows must be open in the **Work Area.**

Shapes from the ***current*** **Animation Source** are displayed ***on the left-hand structure model***.

Shapes from the ***current*** **Comparison Source** are displayed ***on the right-hand structure model***, which is selected from the **Comparison Structure list** on the Toolbar.



Animation Source & Comparison List Boxes During Animate a Pair.

Animate | Animate a Pair | Animate Shapes

If ***checked***, the Structure (**STR**) window is in the **Animation state** and a pair of shapes side-by-side in animation, as shown above.

Animate | Animate a Pair | Show Comparison Source

Displays the ***current*** **Comparison Source** window.

The ***current*** **Comparison Source** is listed in the **Comparison Source list** on the Structure (**STR**) window Toolbar, as shown above.

Animate | Animate a Pair | Flip Right Sign

Multiplies the ***right-hand*** shape by **"-1"**

This command changes the phases of the right-hand shape components by 180 degrees so that the two shapes animate **in-phase** instead of **out-of-phase** with one another.

Animate | Animate a Pair | Closest Frequency Time

Displays shapes from two Sources that are ***closest in frequency (or time).***

When a shape ***is selected*** in one Animation Source, the shape with the ***closest frequency (or time)*** in the other Animation Source is ***automatically selected*** and displayed.

If one of the Animation Sources is a Data Block **(BLK)** or **Acquisition (ACQ)** window, the cursor will move to the ***closest frequency (or time)*** to match the frequency (or time) of the shape in the other Source

Animate | Animate a Pair | Maximum MAC

Displays the shape from the other Source that has the ***maximum MAC value*** with the shape in the active Source.

When a shape from one Animation Source is ***selected***, the shape with the ***maximum MAC value*** in the other Animation Source is ***automatically selected*** and displayed.

If one of the Animation Sources is a Data Block **(BLK)** or **Acquisition (ACQ)** window, the cursor will move to the ***frequency (or time)*** and display the ODS with ***maximum MAC value*** with the shape in the other Source

Animate | Animate a Pair | Shape Difference

If ***checked***, the ***right-hand*** **shape** is replaced with the ***difference*** between the left-hand & right-hand shapes.

The **Animate | Amplitude** commands only change the amplitude of the **Shape Difference**

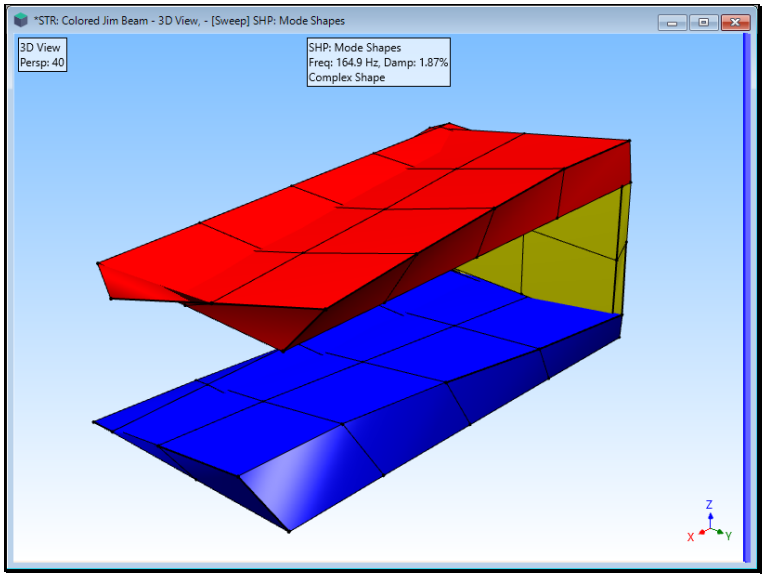
Animate | Animate a Pair | Relative to Left Shape

If ***checked***, the ***right-hand*** **shape** is scaled relative to the ***left-hand*** **shape**.

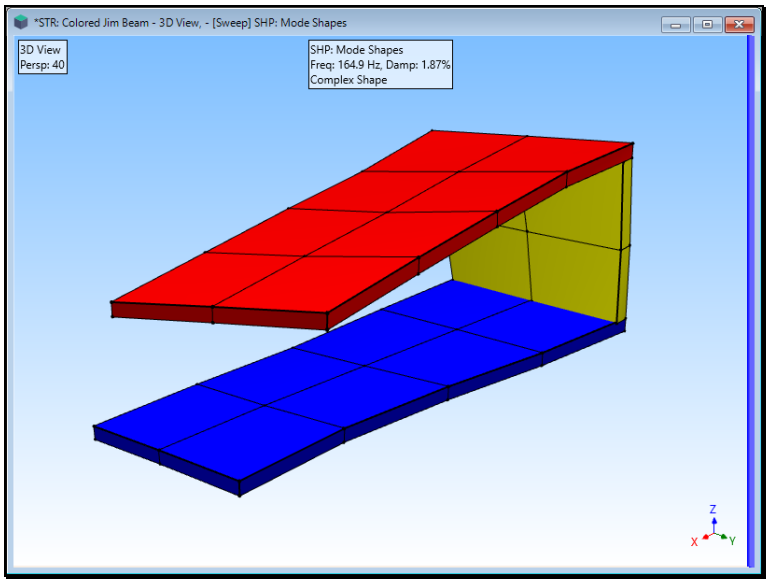
Animate | Use Interpolated Links

If ***checked***, shape values for all DOFs on the structure model with **Interpolated M# Links** are animated using their **Interpolated M# Links**.

- If ***un-checked***, only the **Measured M# Links** are used during animation



Animation with Use Interpolated Links Un-checked



Animation with Use Interpolated Links Checked

Animate | Pause Continue

If ***checked***, animation is **paused**. If ***un-checked***, animation is continued.

- When animation is paused, the current animation frame is displayed, and the **Next Frame** and **Previous Frame** commands are enabled

Animate | Next Frame

Displays the next animation frame.

- ***Press*** the **Right Arrow** on the keyboard to display the ***next*** animation frame

Animate | Previous Frame

Displays the previous animation frame.

- ***Press*** the **Left Arrow** on the keyboard to display the ***previous*** animation frame

Animate | Sweep

Initiates ***sweep animation*** from the ***current*** **Animation Source**.

Sweep Speed from a Data Block (BLK) or Acquisition (ACQ) window

Sweep Speed is controlled by how many samples of **M#** data are either ***skipped over*** or are ***interpolated between*** during animation.

- Sweep speed = **1** ➔ ***every sample*** of **M#** data is displayed during animation
- Sweep speed = **2** ➔ ***every other sample*** is displayed
- Sweep speed = **3** ➔ ***every third sample*** is displayed, and so on
- Sweep speed ***less than*** **1** ➔ shape values are calculated using ***linear interpolation*** between adjacent samples of **M#** data
  - Sweep speed = **0.5** ➔ ***one interpolated value*** is calculated between adjacent samples
  - Sweep speed = **0.33** ➔ ***two interpolated values*** are calculated between adjacent samples, and so on

Sweep Speed from a Shape Table (SHP)

Sweep speed is controlled by completing a **number of sine dwell cycles** before displaying the next shape in the Shape Table (**SHP**).

The number of sine dwell cycles is specified on the **Animation** tab in the **File | Shape Table Options** box.

Animate | Sine Dwell

Initiates **Sine Dwell animation** using **M#** data from the ***current*** **Animation Source**.

During **Sine Dwell animation**, the shape is ***modulated*** by multiplying each shape component by a sine value between **-1 & +1**

Sine Dwell Speed

During **Sine Dwell animation**, the animation speed is controlled by **the number of sine values per cycle** of animation.

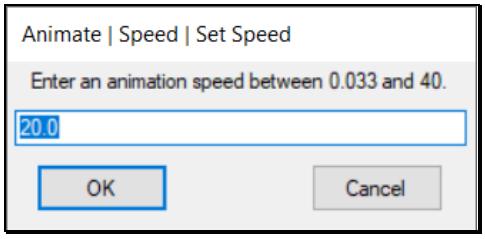
- Dwell speed = **4** ➔ ***four sine values per cycle*** are used
- Dwell speed = **N** (**N > 4**) ➔ **N** ***sine values per cycle*** are used

Animate | Stationary Dwell

Initiates ***Stationary Dwell animation*** using **M#** data from the *current* Animation Source.

Animate | Speed | Set Speed

Use this command to set a specific animation speed.

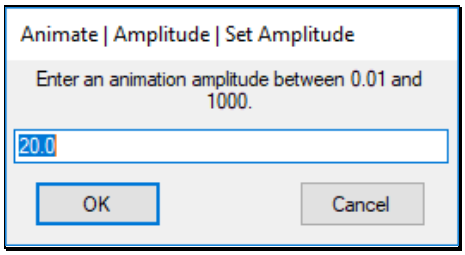


Animate | Speed | Increase or Decrease Speed

- ***Press*** the **Rabbit *to increase*** the animation speed or ***press*** on the **Turtle *to decrease*** the speed

Animate | Amplitude | Set Amplitude

Use this command to set a specific animation amplitude.



Animation amplitude is also used in conjunction with **Animate | Shapes | Fixed Scale** to fix the amplitude of animation

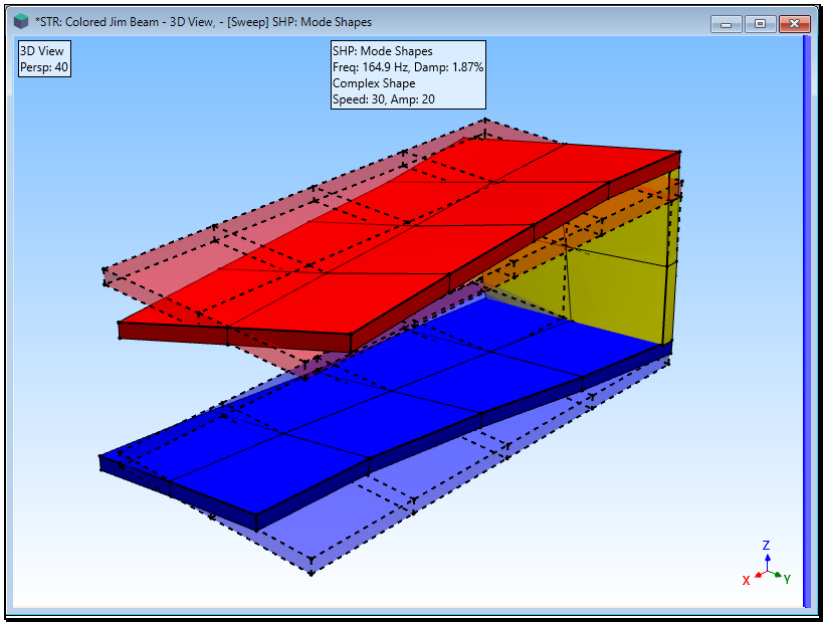
Amplitude | Increase or Decrease Amplitude

- ***Press*** on the **Up Arrow** on the Toolbar ***to increase*** the amplitude, or the **Down Arrow *to decrease*** the amplitude of animation

Amplitude & Speed in the Legend

If **Amplitude & Speed** is ***checking*** on the **Animation** tab in **File | Structure Options**, the animation speed & amplitude are displayed in the **Legend** box during animation.

- ***Click & Drag*** the Legend to ***re-position it*** in the Views



Legend Showing Speed & Amplitude.

Deflection Menu

Deflection | Undeflected

If ***checked***, the ***un-deflected*** structure is displayed during animation, as shown above.

Deflection | Translation

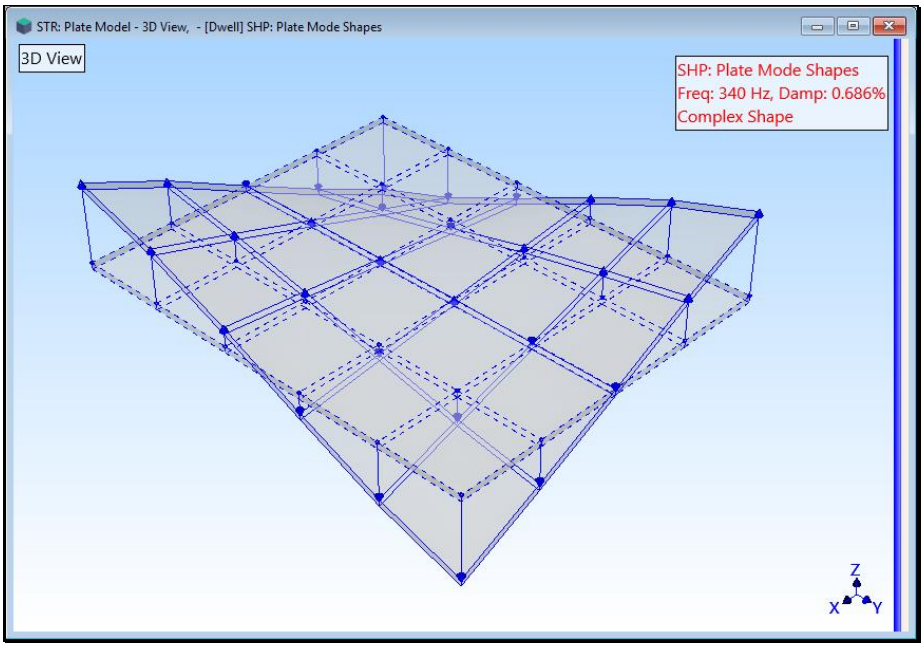
If ***checked***, the structure is ***deflected*** during animation using **translation** data from the ***current*** **Animation Source**.

Deflection | Vectors

If ***checked***, Vectors are used during animation to show deflection at all Points with **Display Vectors ➔ Yes**.

To display Vectors, set **Display Vectors ➔ Yes** in the **Display Vectors** column in the **Points** spreadsheet.

- **Arrow colors** are the same as the **Point colors**



Animation with Vectors & Deflected Checked.

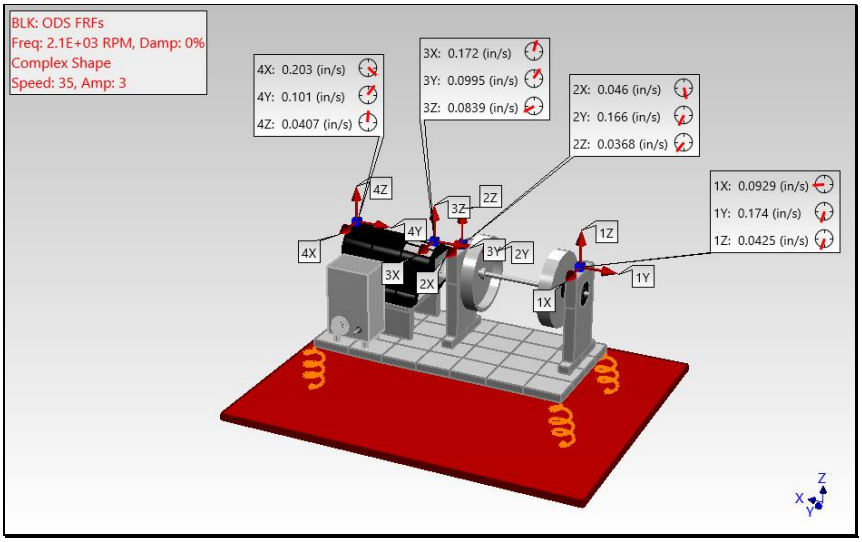
Deflection | Orbits

- If ***checked***, complex shape data is displayed as an ***orbit*** of deflected points about each Point.

Deflection | [Mag & Phs]

If ***checked***, **[Mag & Phs]** is displayed during animation to show deflection at all Points with **Display [Mag & Phs] ➔ Yes**.

To display **[Mag & Phs]**, set **[Mag & Phs] ➔ Yes** in the **Display [Mag & Phs]** column in the **Points** spreadsheet.

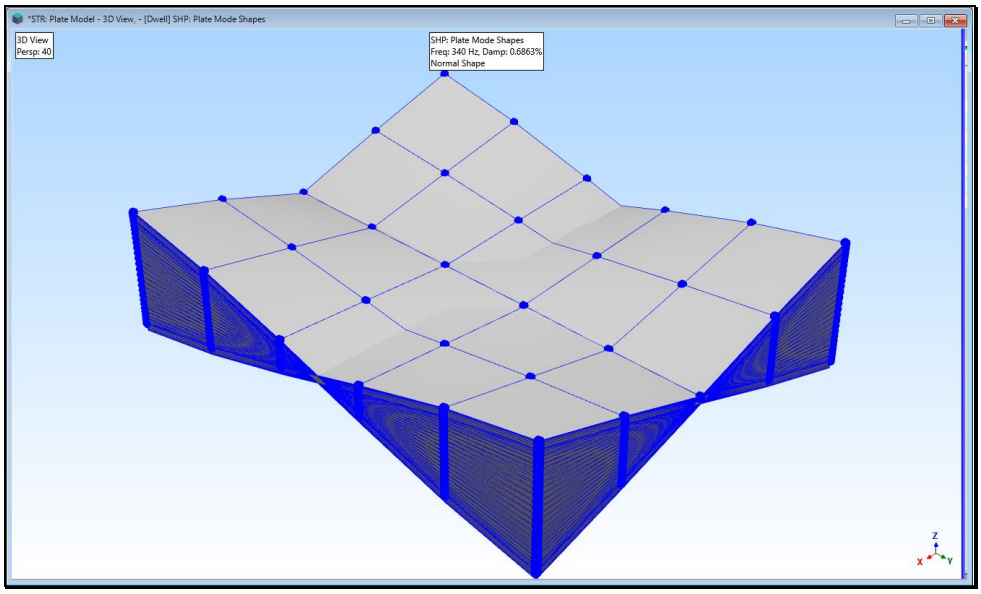


Shape [Mag & Phs] Displayed at Selected Points.

Deflection | Persistence

If ***checked***, animation frames are displayed with ***persistence***.

- Execute **Animate | Persistence *again*** to refresh the Persistence display

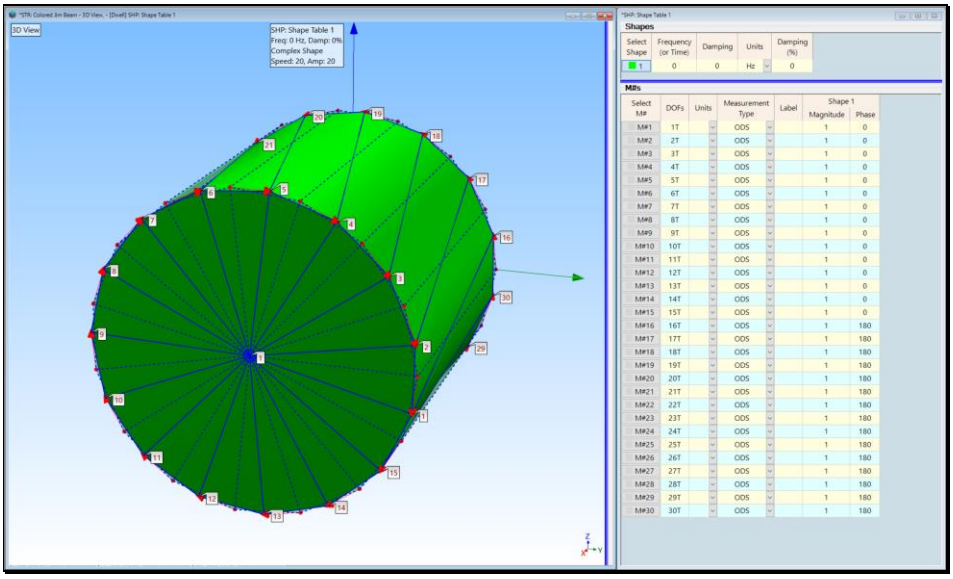


*Sine Dwell Animation with **Persistence.***

Deflection | Torsional

If ***checked***, **Radial Points** are deflected in the **Tangential** direction around their **Center Point**.

The **Tangential** direction is the second coordinate **R** (radial), **T** (tangential), **Z** (axial) of a Radial Point.



Deflection | Vectors, translation & Torsional Checked.

Deflection | Relative to Points

If ***checked***, the **average deflection value** of ***all selected*** **Points *is subtracted*** from the deflection of all other animated Points, and the deflection of the ***selected Points are given no deflection***.

This command is useful for removing background deflection from selected Points and giving them no deflection. The ***average background deflection*** is subtracted from the remaining points thus removing the background deflection for the remaining points.

When this command is executed, **Animate | Pause Continue** is ***checked*** and the animation is paused.

- ***Select*** the Points to have their deflection removed
- Execute **Animate | Pause Continue** again to resume the animation

Deflection | Save Modified Source

When this command is executed, all the **M#s** in the ***current*** **Animation Source** that have had their deflection zeroed by **Deflection | Relative to Points** are removed from the Animation Source.

If the deflection of ***selected*** Points has been zeroed by the **Deflection | Relative to Points** command, this command deletes all of the data from the ***current*** **Animation Source** that ***was linked using*** **M# Links** to the ***selected*** Points.

Deflection | Shapes | Save Shape

Saves the ***current*** animated shape into a Shape Table (**SHP**).

Deflection | Shapes | Auto Scale

If ***checked***, each shape component is ***divided*** by the ***maximum*** component of the displayed shape

When **Dwell** animation is started, Auto Scale is ***automatically checked*** unless Fixed Scale is ***checked.***

Deflection | Shapes | Relative Scale

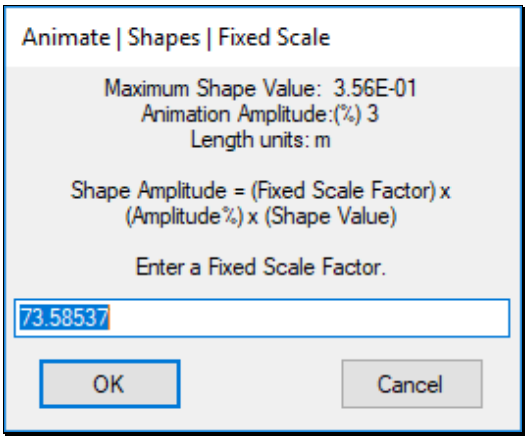
When checked, each shape is divided by the maximum of all **M#** data in the current Animation Source

When **Sweep** animation is started, Relative Scale is ***automatically checked*** unless Fixed Scale is ***checked.***

Deflection | Shapes | Fixed Scale

When ***checked***, each shape is scaled using a ***user-defined percentage*** of the maximum structure coordinate.

When **Shapes | Fixed Scale** is executed, a dialog box is opened



Fixed Scale Example

If a structure model has the following values and a **% of Max. Coord = 20 percent** is entered into the dialog box, the fixed scale factor for animation is calculated as follows,

- Largest structure coordinate ➔ **100** Length Units
- Percentage of the largest structure coordinate ➔ **20%**
- Maximum shape component (**M#** value) ➔ **10**
- Animation Amplitude ➔ **1**
- Fixed Scale Factor ➔ **(0.20 x 100) / (1 x 10) ➔ 2**

Deflection | Contours Menu

A ***contour is a locus of equal values*** of the currently displayed shape.

Contours are displayed as **fill colors** on the surfaces of a structure model.

Contour colors are chosen on the **Contour Colors** tab in the **File | Options** dialog box of the ***current*** **Animation Source.**

Deflection | Contours | Node Lines

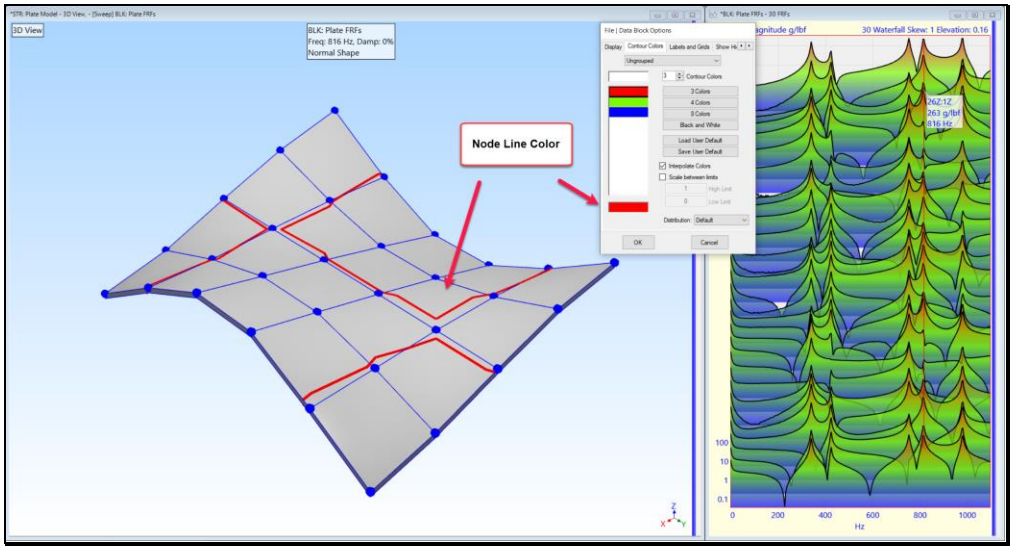
If ***checked***, **Node Lines** are displayed on the surfaces of the surface model during shape animation

Node Lines are locations on a surface where the ***shape values are zero.***

Node Lines are displayed as ***heavy black lines*** on a surface.

Node Line Color

The color of the node lines is taken from the bottom color in the Options box of the current Animation Source, as shown below.

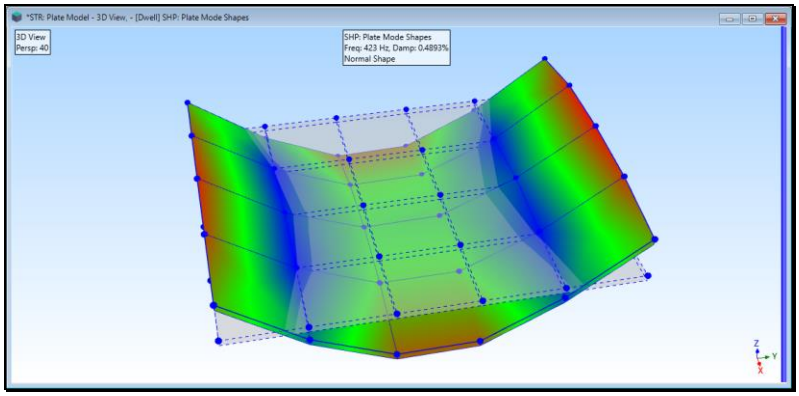


Node Line Color Taken From BLK Options Box.

Deflection | Contours | Contour Colors

If ***checked***, shape values are displayed using contour colors on the surfaces of a structure model.

- Contour colors are based on the ***magnitudes*** of the shape values
- Contours are ***only displayed*** on Surfaces
- The data type to be displayed with contours is specified in the **Contours Data Type** column of the Substructures or Surfaces spreadsheets



Animation with Contour Colors and Color Key Displayed.

Deflection | Contours | Point ICONs

If ***checked***, displays shape data at a Point using color contours on its Point **ICON.**

Deflection | Contours | Color Key

If ***checked***, contour values are displayed in a **Color Key** in all Views.

Deflection | Contours | Surface Normals

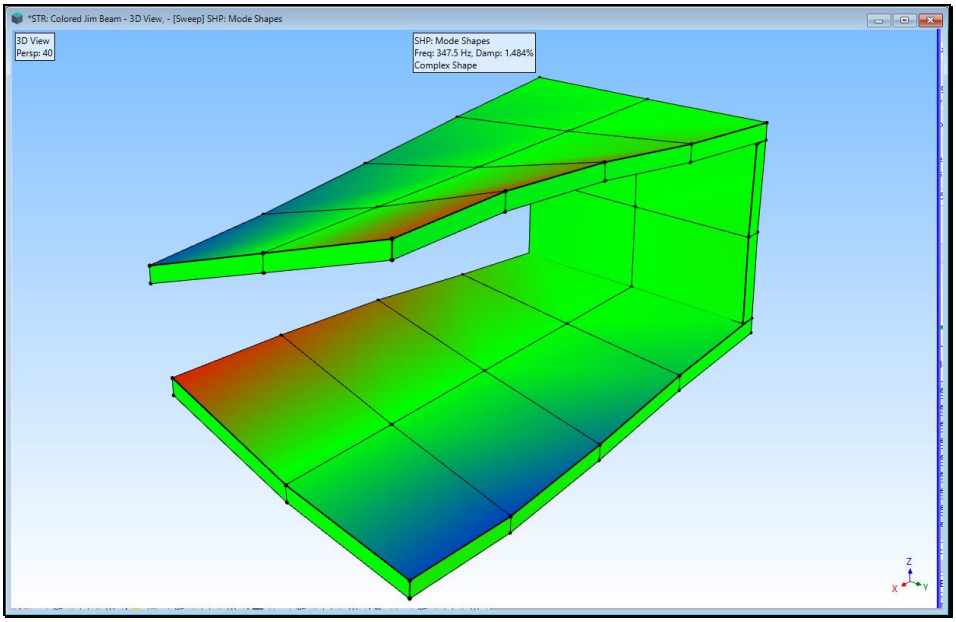
If ***checked***, the surface normals are used to determine whether a shape value is ***"above"*** or ***"below"*** each surface on the structure model.

If the **dot product** of the shape value with the **surface normal** is **positive**, the shape value is ***"above"*** the surface.

If the **dot product** of the shape value with the **surface normal** is **negative**, the shape value is ***"below"*** the surface.

To display the color contours of shape values ***"above"*** & ***"below"*** each surface,

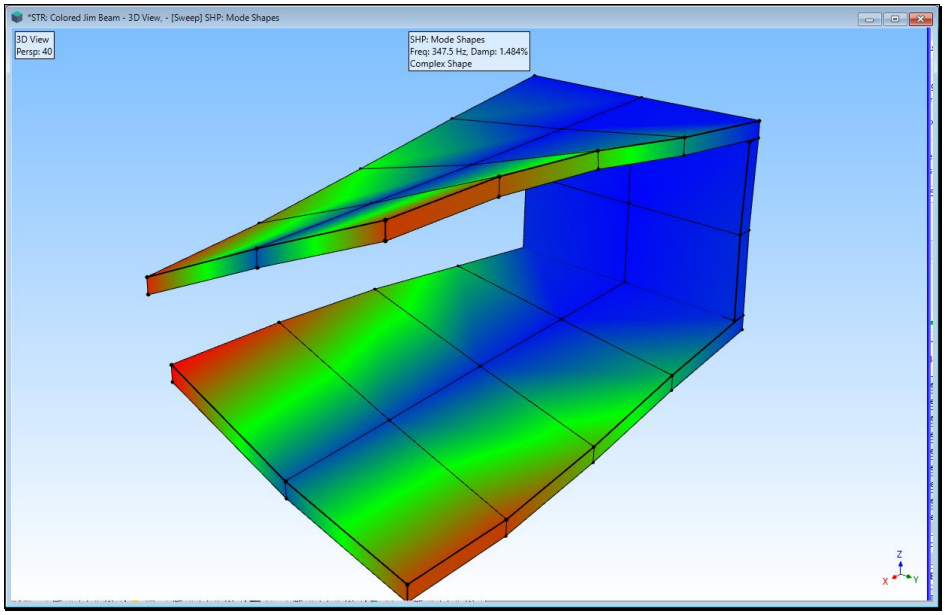
- Execute **Deflection | Contours | Contour Colors**
- Execute **Deflection | Contours | Color Key**
- Execute **Deflection | Contours | Surface Normals**
- The **Color Key** shows one color for ***"positive"*** and a different color for ***"negative"*** values, as shown below



Animation of Surface Normal Contours.

Magnitude Only

- If **Deflection | Contours | Surface Normals** is ***not checked***, the ***magnitude*** of the shape values at each Point is used to display color contours
  - Now the **Color Key** contains colors for ***magnitudes only***, and that the contour colors are displayed differently, as shown below



Animation of Magnitude Contours.

Deflection | Animate Using | Groups

If ***checked***, scales the **M#** data from ***each* Group** during shape animation from the ***current* Animation Source**

- Scales shape data for each group in the **Group column** in the **M#s** spreadsheet in a Data Block (**BLK**), Acquisition (**ACQ**), or Shape Table (**SHP**)
  - For example, if the **M#s** in a **Group *called "Acoustic Power"*** have values in the range **(+100, -100)**, all shape data from that **Group** will be scaled using **100**
  - If **M#s** in another ***Group called "Vibration"*** have values in the range (**+10,000, -10,000**), all shape data from that **Group** will be scaled using **10,000**
- If there are no names in the **Group column** of the ***current* Animation Source**, ***all* M#s** are scaled as a single group

Deflection | Animate Using | Acoustic Sources

If ***checked,*** scales the **M#** data from ***each* Acoustic Source** during shape animation from the ***current* Animation Source**.

- Scales shape data for each group in the **Acoustic Source** in the **M#s** spreadsheet in a Data Block (**BLK**), Acquisition (**ACQ**), or Shape Table (**SHP**)

Deflection | X [R H]

If ***checked***, shape values in the **Measurement Axes X [R**adial **H**orizontal**]** direction are displayed.

Deflection | Y [T V]

If ***checked***, shape values in the **Measurement Axes Y [T**angential **V**ertical**]** direction are displayed.

Deflection | Z [P A]

If ***checked***, shape values in the **Measurement Axes Z [P**hase **A**xial**]** direction are displayed.

Script Menu

The commands in the **Script** menu for this window can be added to any Script (**VSL**) window and used together ***with other MEscope commands*** to ***automate the execution*** of MEscope commands.

When the **Hotkey** is ***pressed***, the commands in the Script (**VSL**) referenced by the **Hotkey** are executed.

Script | Drawing Objects | Select

Selects (or ***un-selects***) a range of Objects by ***row number*** in the ***current* Objects** spreadsheet.

Parameters

- A ***range of row numbers*** in the ***current* Objects** spreadsheet (Examples; 1,2,3; 1-3; all)
- Select (Yes or No)
- Un-select All First (Yes or No)

Script | Drawing Objects | Select an Object

Selects (or ***un-selects***) an Object by its ***row number*** in the ***current* Objects** spreadsheet.

Parameters

- Object Row Number (can also be a Script variable)
- Select (Yes or No)
- Un-select All First (Yes or No)

Script | Drawing Objects | Visibility

Shows or Hides ***all*** (or ***selected***) Objects in the ***current*** **Objects** spreadsheet.

Parameter

- Object Visibility (Yes or No)

Script | Drawing Objects | Label

Changes the label of ***all*** (or ***selected***) Objects in the ***current*** **Objects** spreadsheet.

Parameter

- Object Label (text)

Script | Drawing Objects | Display Label

Sets **Display Label** to **Yes** or **No** for ***all*** (or ***selected***) Objects in the ***current*** **Objects** spreadsheet.

Parameter

- Display Label (Yes or No)

Script | Drawing Objects | Color

Changes the color of ***all*** (or ***selected***) Objects in the ***current*** **Objects** spreadsheet.

Parameter

- Object Color

Script | Drawing Objects | Size or Width

Changes the size or width of ***all*** (or ***selected***) Objects in the ***current*** **Objects** spreadsheet.

Parameter

- Object Size or Width (1-9)

Script | Points | Display Always

Sets **Display Always** to **Yes** or **No** for ***all*** (or ***selected***) Points in the ***current*** **Objects** spreadsheet.

Parameter

- Display Always (Yes or No)

Script | Drawing Objects | Display Mag & Phs

Sets **Display Mag & Phs** to **Yes** or **No** for ***all*** (or ***selected***) Points in the ***current*** **Objects** spreadsheet.

Parameter

- Display Mag & Phs (Yes or No)

Script | Drawing Objects | Display Translation

Sets **Display Translation** to **Yes** or **No** for ***all*** (or ***selected***) Points in the ***current*** **Objects** spreadsheet.

Parameter

- Display Translation (Yes or No)

Script | Drawing Objects | Display Vectors

Sets **Display Vectors** to **Yes** or **No** for ***all*** (or ***selected***) Points in the ***current*** **Objects** spreadsheet.

Parameter

- Display Vectors (Yes or No)

Script | Drawing Objects | Display Orbits

Sets **Display Orbits** to **Yes** or **No** for ***all*** (or ***selected***) Points in the ***current*** **Objects** spreadsheet.

Parameter

- Display Orbits (Yes or No)

Script | Drawing Objects | Display Transparent

Sets **Display Transparent** to **Yes** or **No** for ***all*** (or ***selected***) Surfaces in the ***current*** **Objects** spreadsheet.

Parameter

- Display Transparent (Yes or No)

Script | Drawing Objects | Set Animation Source

Sets the ***current*** **Animation Source** in a structure (**STR**) window.

Parameter

- Animation Source

Script | Drawing Objects | Copy Cells to Clipboard

Copies cells from the current Objects spreadsheet to the Clipboard.

Parameters

- Top Left Row
- Top Left Column
- Bottom Right Row
- Bottom Right Column

Script | Drawing Objects | Paste Clipboard to Cells

Pastes data from the Clipboard into cells in the ***current*** **Objects** spreadsheet**.**

Parameters

- Top Left Row
- Top Left Column
- Bottom Right Row
- Bottom Right Column

Script | Drawing Objects | Copy Cell to Variable

Copies a cell from the ***current*** **Objects spreadsheet** to a Script variable.

Parameters

- Row
- Column
- Variable Name

Script | Drawing Objects | Paste Variable to Cell

Pastes a Script variable into a cell in the ***current*** **Objects** spreadsheet.

Parameters

- Row
- Column
- Variable Name

Script | Get | Object Count to Variable

Saves the number of **Objects** in the ***current* Objects** spreadsheet into a Script Variable.

Parameter

- Variable Name

Script | Get | Next Selected Object to Variable

Increments to the next ***selected* Object** in the ***current* Objects** spreadsheet and saves it into a Script Variable.

Parameter

- Variable Name

Script | Get | Selected Object Count to Variable

Saves the number of ***selected* Objects** in the ***current* Objects** spreadsheet into a Script Variable.

Parameter

- Variable Name

Script | Get | Next Selected Object to Variable

Saves the ***next selected* Object** (starting after an **Object)** in the ***current* Objects** spreadsheet into a Script Variable.

Parameters

- Start After Object (number or variable)
- Variable Name