



## Structure (STR) Window

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## Table of Contents

<b>Structure (STR) Window .....</b>	<b>11</b>
Drawing & Animation States.....	11
Animation Sources .....	11
Graphics Area & Objects Spreadsheet.....	12
Menu Commands.....	12
<b>Mouse &amp; Keyboard Operations .....</b>	<b>12</b>
Right Click Menus.....	12
Re-Ordering Spreadsheet Columns .....	12
Spreadsheet Vertical Scrolling.....	12
Spreadsheet Text Size.....	12
Cut, Copy & Paste Text.....	12
Rotation in the 3D View .....	12
Zoom In or Out on the Structure Model .....	12
Panning the Structure Model .....	13
Selecting Objects in the Objects Spreadsheet.....	13
Arrow Keys During Dwell Animation.....	13
<b>Objects Spreadsheet .....</b>	<b>13</b>
Select Object Column .....	13
Visible Column.....	13
Label Column .....	13
Color Column .....	13
Object Size or Width Column.....	13
Showing & Hiding Spreadsheet Columns .....	13
Reset Spreadsheet Column Widths.....	13
Re-Ordering Spreadsheet Columns .....	13
Scroll Bars .....	13
Spreadsheet Text Size.....	14
Cut, Copy & Paste Text.....	14
<b>Editing Spreadsheet Properties by Column .....</b>	<b>14</b>
<b>Points Spreadsheet.....</b>	<b>14</b>
Label Column .....	14
Display Label Column.....	15
Point Coordinates Columns .....	15
Typing in Point Coordinates .....	15
Pasting Coordinates from the Clipboard.....	15

Display Always Column.....	16
Normal.....	16
Always.....	16
Center Points & Radial Points .....	16
Center Point .....	16
Radial Point .....	16
Rotating Substructure .....	16
Display Translation Column.....	16
Display Vectors Column.....	16
Display Orbits Column .....	16
Display [Mag & Phs] Column .....	16
ICON Column.....	17
Rotating a Point ICON.....	17
Resizing a Point ICON .....	17
Acoustic Area & Normal Columns.....	17
Acoustic Area .....	17
Acoustic Normal.....	17
<b>Adding Points to a Model .....</b>	<b>17</b>
Adding Points Graphically .....	17
Adding Points to the Points Spreadsheet .....	17
Editing Point Coordinates.....	17
Distance Between Two Points .....	18
<b>Lines Spreadsheet .....</b>	<b>18</b>
Adding Lines to a Model.....	19
<b>Surfaces Spreadsheets .....</b>	<b>19</b>
Surface Triangles Spreadsheet.....	19
Surface Quads Spreadsheet.....	20
Adding Surfaces to a Model .....	20
<b>Substructures Spreadsheet .....</b>	<b>21</b>
Object Properties Column.....	21
Transparent Column .....	21
Hide Texture Column .....	21
Contours Data Type Column .....	22
Translation.....	22
Machine Rotation .....	22
Scalar.....	22
None .....	22

<b>Creating a Substructure .....</b>	<b>22</b>
<b>Rotating Substructure .....</b>	<b>22</b>
Creating a Rotating Substructure .....	22
Testing the Rotation.....	23
<b>File Menu.....</b>	<b>23</b>
File   Save Structure .....	23
File   Save Structure As .....	23
File   Save In Models Library .....	23
Saving Substructures in the Models Library .....	23
File   Save Graphics in a File .....	23
File   Export Structure.....	24
<b>Exporting a UFF File .....</b>	<b>24</b>
Exporting a Structure & Shape Table (SHP) into the Same UFF File .....	24
<b>Importing a Structure Model in Text Format .....</b>	<b>24</b>
1. Create a Text File Template.....	24
2. Add Your Data to the Text File Template .....	24
3. Import the Text (.TXT) File.....	24
File   Copy to Clipboard   Copy Graphics .....	25
File   Copy to Clipboard   Copy Objects Spreadsheet.....	25
File   Print   Graphics .....	25
File   Print   Spreadsheet .....	25
File   Clone Structure + Source.....	26
File   Structure Options .....	26
Display Tab .....	27
Colors Section.....	27
Vertical Axis Section.....	27
Background Image Section.....	27
Image Locked to Structure.....	27
Labels Tab .....	27
Axes Lines .....	27
XYZ Axes.....	27
Legend .....	27
User Label .....	27
Object Labels.....	27
Show Hide Tab .....	27
Lights Tab.....	27
Light Controls.....	27

Light Positions .....	28
Animation Tab .....	28
Animation Legend Section .....	29
[Mag+Phs] Section .....	29
Compare Shapes Section .....	29
Colors Section.....	29
Synchronize Rotation.....	29
File   Close Structure .....	29
Opening a Window .....	29
<b>Selecting Objects .....</b>	<b>30</b>
Selecting All Objects .....	30
Un-selecting All Objects.....	30
Selecting a Range of Objects .....	30
<b>Display Menu .....</b>	<b>30</b>
Display   Center Structure Window .....	30
Display   Objects SS .....	30
Display   Structure Toolbars .....	30
Display   View   Active View .....	30
Quad View Versus Single View .....	31
Display   View   Flip View.....	31
Display   View Control .....	31
Vectors (3D View only).....	32
Circle (3D View only) .....	32
Middle Ball.....	32
Vertical scroll bar .....	32
Horizontal scroll bar .....	32
Star.....	32
Display   Points   Show Points .....	32
Display   Points   Point Labels .....	32
Display   Points   Acoustic Normals .....	32
Display   Points   Point ICONs.....	32
Display   Lines   Show Lines .....	32
Display   Lines   Line Labels .....	32
Display   Surfaces   None.....	33
Display   Surfaces   Filled .....	33
Display   Surfaces   Outlined.....	33
Display   Surfaces   Texture .....	33

Display   Surfaces   Transparent .....	33
Display   Surfaces   Surface Labels .....	33
Display   Surfaces   Lights .....	33
Display   Surfaces   Surface Normals .....	33
Display   Surfaces   Reverse Normals .....	33
Display   Zoom In .....	33
Zooming with the Mouse Wheel .....	33
Display   Zoom Out .....	33
Display   Re-Center All Views .....	33
Display   Auto Rotate 3D View   Rotate CCW .....	34
Display   Auto Rotate 3D View   Rotate CW .....	34
Display   Auto Rotate 3D View   Stop .....	34
<b>Edit Menu .....</b>	<b>34</b>
Edit   Undo .....	34
Edit   Redo .....	34
Current Object Type .....	34
Edit   Select Objects   Select All .....	34
Edit   Select Objects   Invert Selection .....	34
Edit   Select Objects   Select None .....	34
Edit   Select Objects   Select Labeled .....	34
Edit   Select Objects   Interactive .....	34
Using a Mouse Click .....	34
Using a Selection Box .....	35
Edit   Move Up or Down .....	35
Edit   Add Objects .....	35
Edit   Sort Objects by Label .....	35
Edit   Sort Objects by Color .....	36
Edit   Copy Objects to File .....	36
Rules for Copying Objects .....	36
Edit   Paste Objects from File .....	37
Rules for Pasting Objects .....	37
Edit   Delete Objects .....	37
Rules for Deleting Objects .....	37
<b>Draw Menu .....</b>	<b>37</b>
Draw   Draw Structure .....	37
Draw   Drawing Assistant .....	37
Using the Drawing Assistant .....	37

Substructure Tab .....	38
Editable Substructures .....	38
Dimensions Tab .....	38
Position Tab .....	38
Extrude Tab .....	38
Revolve Tab .....	39
Draw   Points   Number Points .....	39
Draw   Points   Add Point to Line .....	39
Draw   Points   Add Point to Surface .....	40
Draw   Points   Remove Duplicate Points .....	40
Draw   Points   Create Center Point .....	40
Draw   Substructures   Add Objects to Substructure .....	40
Draw   Substructures   Remove Objects from Substructure .....	41
Draw   Resize Objects .....	42
Resizing Point ICONs .....	42
Draw   Drag Objects .....	42
Draw   Rotate Objects .....	43
Rotating Point ICONs .....	43
Draw   Mesh Objects Menu .....	44
Draw   Mesh Objects   Mesh All Edges .....	44
Draw   Mesh Objects   Mesh Longest Edges .....	45
Meshing Substructures .....	45
Creating Interpolated M# Links During Meshing .....	45
<b>M# Links Menu .....</b>	<b>46</b>
Measured Link .....	46
Interpolated Link .....	46
Fixed DOF .....	46
M# Links   Measurement Axes .....	47
Rotating the Measurement Axes .....	47
Increment (deg.) .....	47
Reset button .....	47
M# Links   Links Editor .....	48
Translation Link .....	48
Scalar Link .....	48
Machine Rotation Link .....	49
M# Links   Create Measured Links .....	49
Match Structure and Source DOFs .....	49



Measurement Axes .....	49
Measured Link Creation .....	50
Link M#s Graphically.....	50
M# Links   Create Interpolated Links .....	51
M# Links   Interpolated > Measured.....	52
M# Links   Fix directions.....	52
M# Links   Delete Fixed DOFs .....	53
M# Links   Delete Links .....	53
M# Links   Show M# Links .....	54
Measured Links .....	54
Interpolated Links.....	54
Fixed DOFs .....	54
M# Links   Select M#s .....	54
M# Links   Select Source M#s .....	54
M# Links   Update Source Roving DOFs .....	55
M# Links   Expand Source M#s .....	55
<b>Animate Menu.....</b>	<b>55</b>
Animate   Animate a Shape .....	55
Requirements for Animation .....	55
Animate   Show Animation Source.....	55
Animation from a Data Block (BLK) or Acquisition (ACQ) .....	55
Animation from a Shape Table (SHP).....	56
Which Shape Data is Displayed?.....	56
Changing the Current Animation Source.....	56
Selected M#s.....	56
Animate   Animate a Pair Menu .....	56
Animate   Animate a Pair   Animate Shapes .....	57
Animate   Animate a Pair   Show Comparison Source.....	57
Animate   Animate a Pair   Flip Right Sign.....	57
Animate   Animate a Pair   Closest Frequency Time .....	57
Animate   Animate a Pair   Maximum MAC .....	57
Animate   Animate a Pair   Shape Difference .....	57
Animate   Animate a Pair   Relative to Left Shape .....	58
Animate   Use Interpolated Links .....	58
Animate   Pause Continue .....	58
Animate   Next Frame.....	59
Animate   Previous Frame.....	59

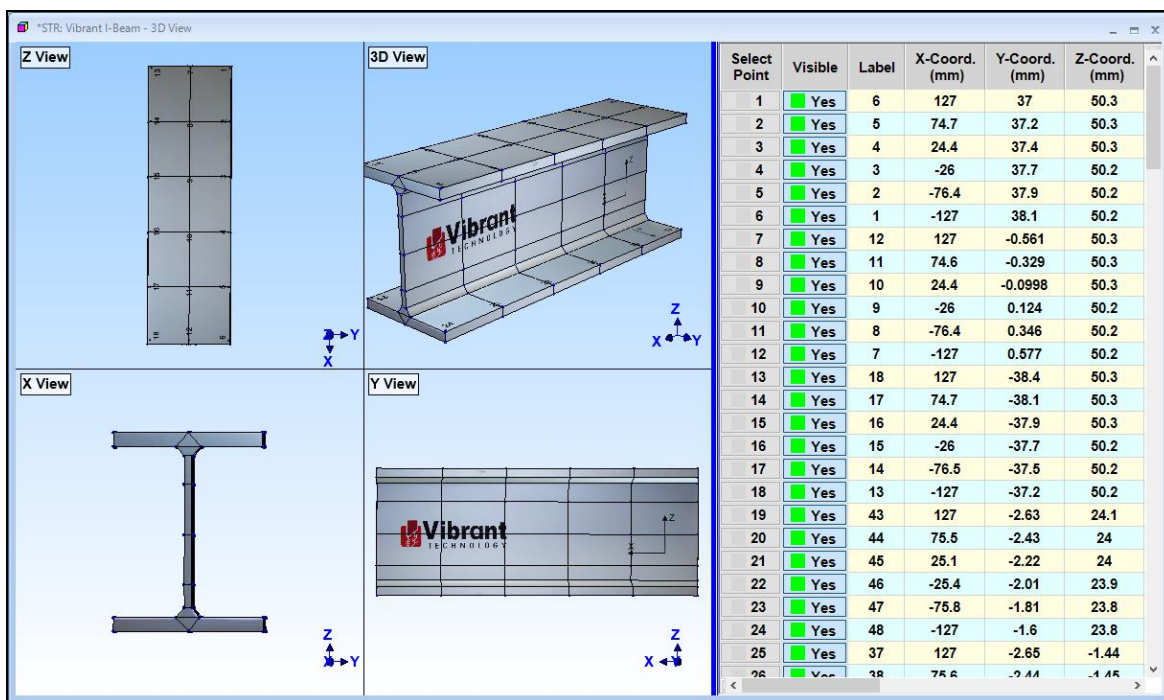
Animate   Sweep .....	59
Sweep Speed from a Data Block (BLK) or Acquisition (ACQ) window .....	59
Sweep Speed from a Shape Table (SHP).....	59
Animate   Sine Dwell.....	59
Sine Dwell Speed.....	59
Animate   Stationary Dwell.....	59
Animate   Speed   Set Speed .....	59
Animate   Speed   Increase or Decrease Speed .....	60
Animate   Amplitude   Set Amplitude.....	60
Amplitude   Increase or Decrease Amplitude .....	60
Amplitude & Speed in the Legend .....	60
<b>Deflection Menu .....</b>	<b>61</b>
Deflection   Undeflected .....	61
Deflection   Translation .....	61
Deflection   Vectors .....	61
Deflection   Orbits.....	61
Deflection   [Mag & Phs].....	61
Deflection   Persistence.....	62
Deflection   Torsional .....	62
Deflection   Relative to Points .....	63
Deflection   Save Modified Source .....	63
Deflection   Shapes   Save Shape .....	63
Deflection   Shapes   Auto Scale .....	63
Deflection   Shapes   Relative Scale.....	63
Deflection   Shapes   Fixed Scale.....	63
Fixed Scale Example .....	64
Deflection   Contours Menu.....	64
Deflection   Contours   Node Lines .....	64
Node Line Color .....	64
Deflection   Contours   Contour Colors.....	65
Deflection   Contours   Point ICONs.....	65
Deflection   Contours   Color Key .....	65
Deflection   Contours   Surface Normals .....	65
Magnitude Only .....	66
Deflection   Animate Using   Groups .....	67
Deflection   Animate Using   Acoustic Sources .....	67
Deflection   X [R H] .....	67

Deflection   Y [T V].....	67
Deflection   Z [P A] .....	67
<b>Script Menu.....</b>	<b>67</b>
Script   Drawing Objects   Select .....	67
Parameters .....	67
Script   Drawing Objects   Select an Object .....	67
Parameters .....	67
Script   Drawing Objects   Visibility .....	68
Parameter .....	68
Script   Drawing Objects   Label .....	68
Parameter .....	68
Script   Drawing Objects   Display Label.....	68
Parameter .....	68
Script   Drawing Objects   Color .....	68
Parameter .....	68
Script   Drawing Objects   Size or Width .....	68
Parameter .....	68
Script   Points   Display Always.....	68
Parameter .....	68
Script   Drawing Objects   Display Mag & Phs.....	68
Parameter .....	68
Script   Drawing Objects   Display Translation.....	68
Parameter .....	68
Script   Drawing Objects   Display Vectors .....	68
Parameter .....	68
Script   Drawing Objects   Display Orbits.....	69
Parameter .....	69
Script   Drawing Objects   Display Transparent.....	69
Parameter .....	69
Script   Drawing Objects   Set Animation Source .....	69
Parameter .....	69
Script   Drawing Objects   Copy Cells to Clipboard .....	69
Parameters .....	69
Script   Drawing Objects   Paste Clipboard to Cells .....	69
Parameters .....	69
Script   Drawing Objects   Copy Cell to Variable .....	69
Parameters .....	69

Script   Drawing Objects   Paste Variable to Cell .....	69
Parameters .....	69
Script   Get   Object Count to Variable .....	70
Parameter .....	70
Script   Get   Next Selected Object to Variable.....	70
Parameter .....	70
Script   Get   Selected Object Count to Variable.....	70
Parameter .....	70
Script   Get   Next Selected Object to Variable.....	70
Parameters .....	70

## 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 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*

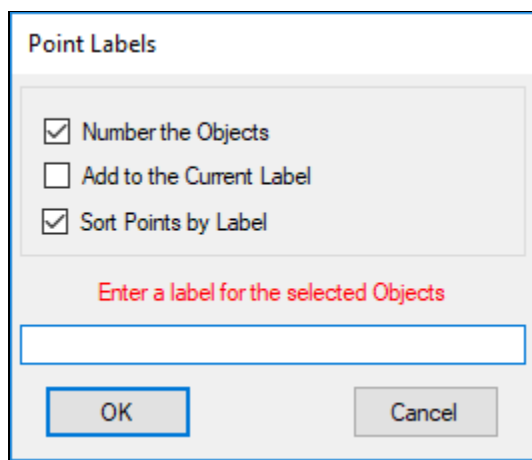
### Cut, Copy & Paste Text

*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**



The dialog box is titled "Point Labels". It contains three checkboxes: "Number the Objects" (checked), "Add to the Current Label" (unchecked), and "Sort Points by Label" (checked). Below these is a red text prompt "Enter a label for the selected Objects" followed by a text input field. At the bottom are "OK" and "Cancel" buttons.

## 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**

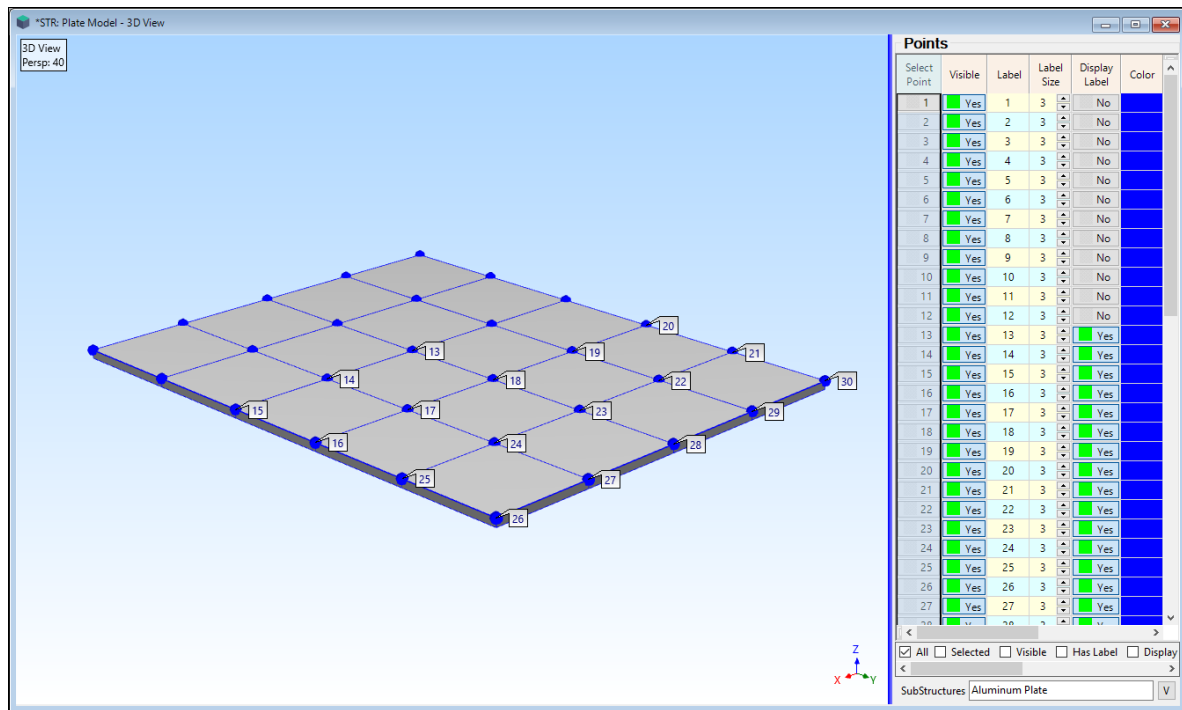
### Label Column

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 Point** 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 is 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**

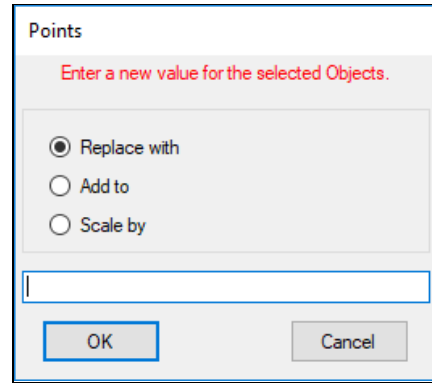
**WARNING:** When **Edit | Add Objects** is **checked**, **each click** of the left mouse **will add a new Point** to the structure model.

### 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

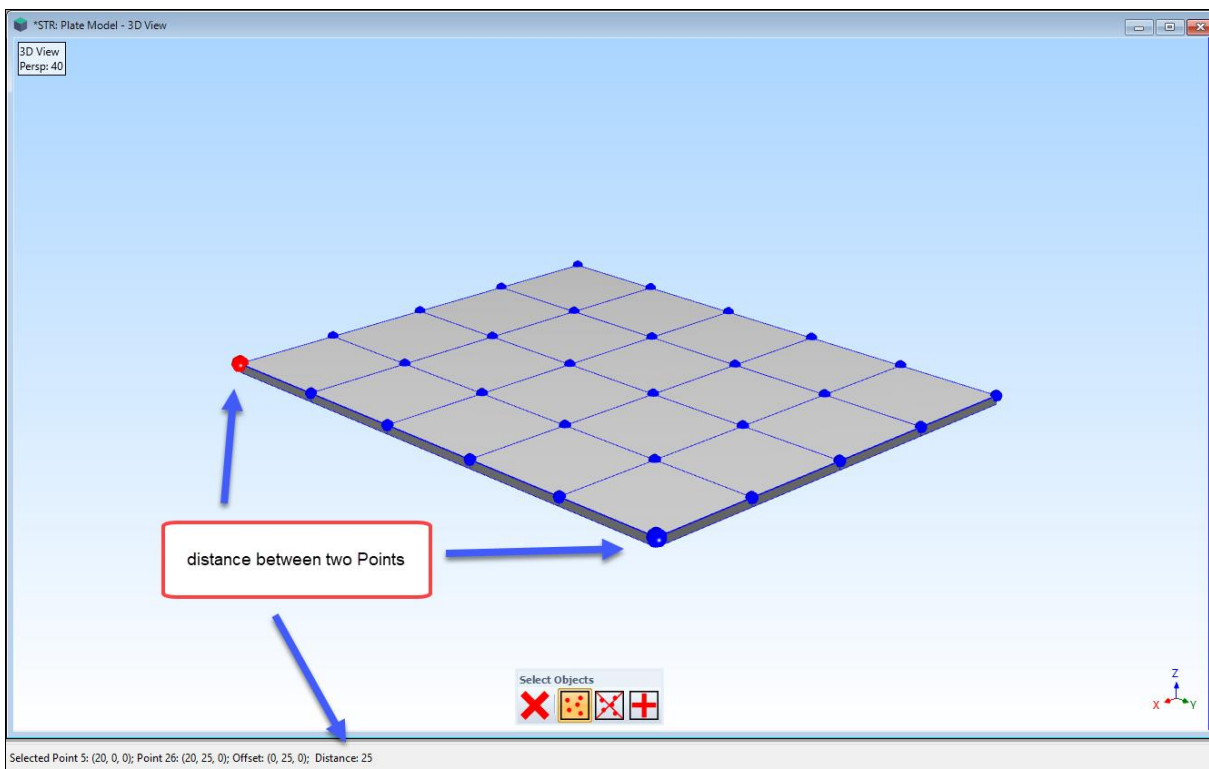
- **Select** the Points with coordinates to be edited
- **Double click** on the appropriate **X-Coord**, **Y-Coord** or **Z-Coord** column heading to edit the coordinates of the **selected** Points
  - In the dialog box that opens, choose **Replace with**, **Add to** or **Scale by**
  - Enter the new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



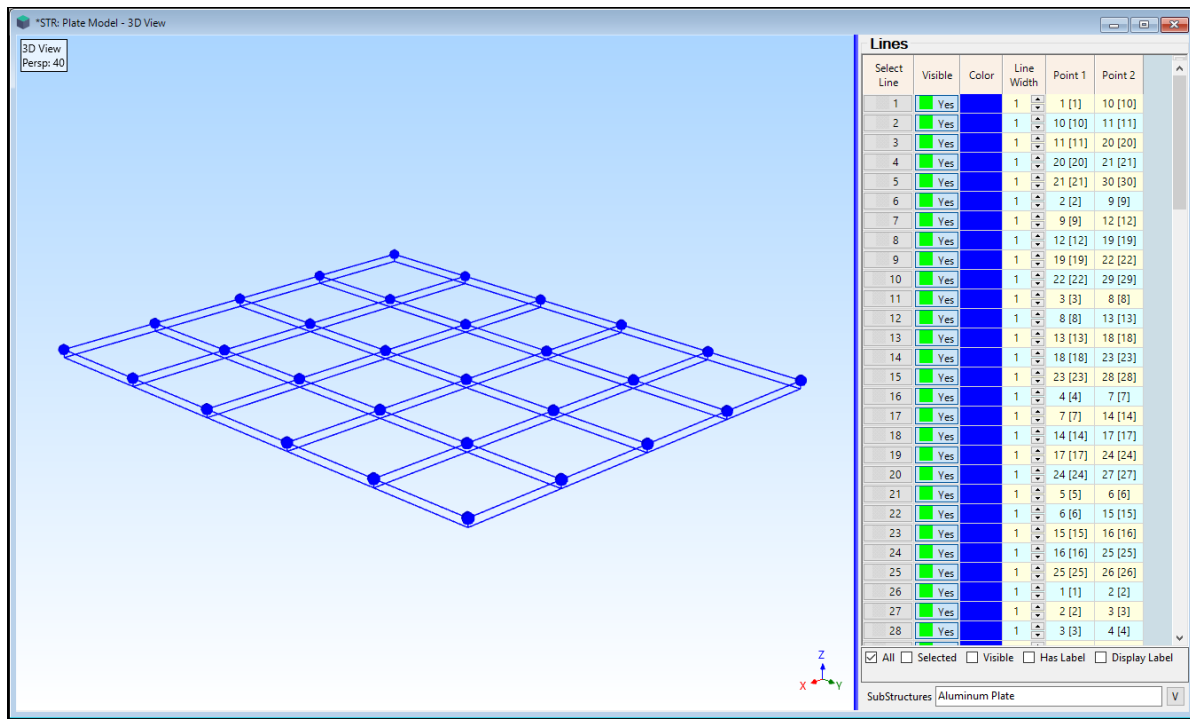
*Distance Between Two Points Shown on Status Bar.*

## 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**

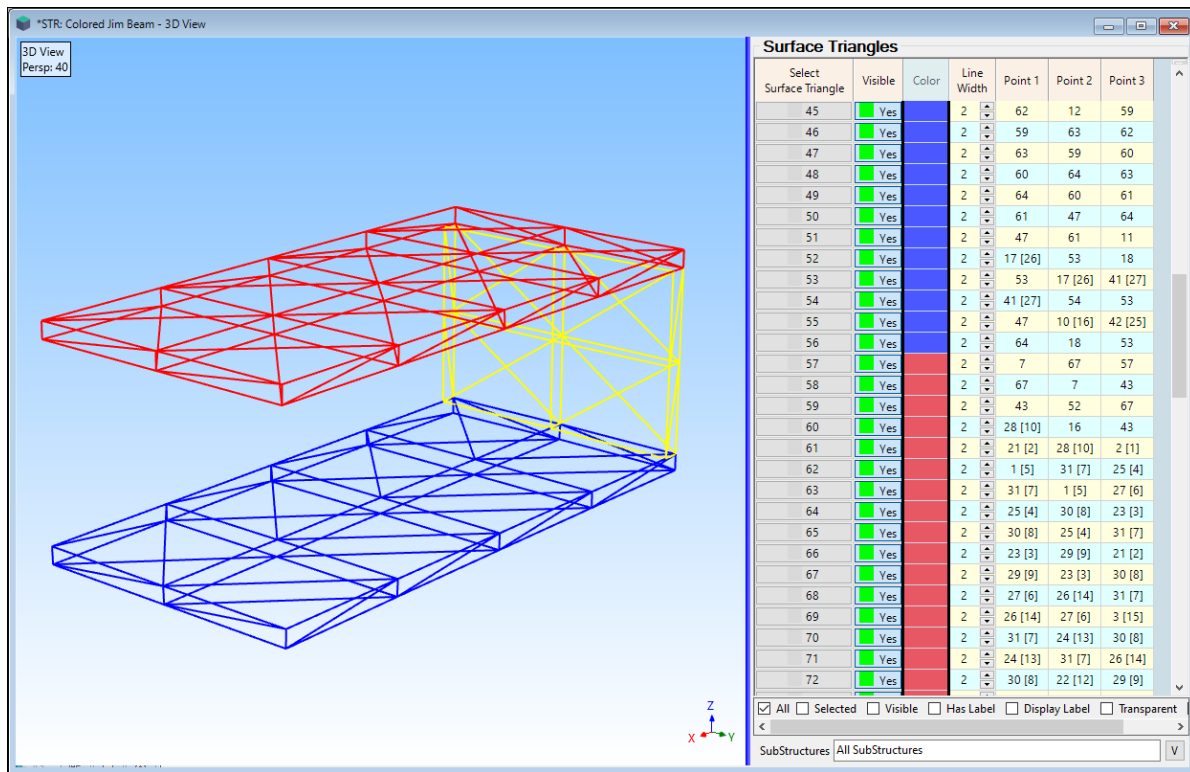
These two spreadsheets contain the properties of **all Surface Triangles** and **all Surface Quads** on a structure model. Surfaces are required for displaying **solid models**, **surface textures**, or **contour colors** during animation.

- **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

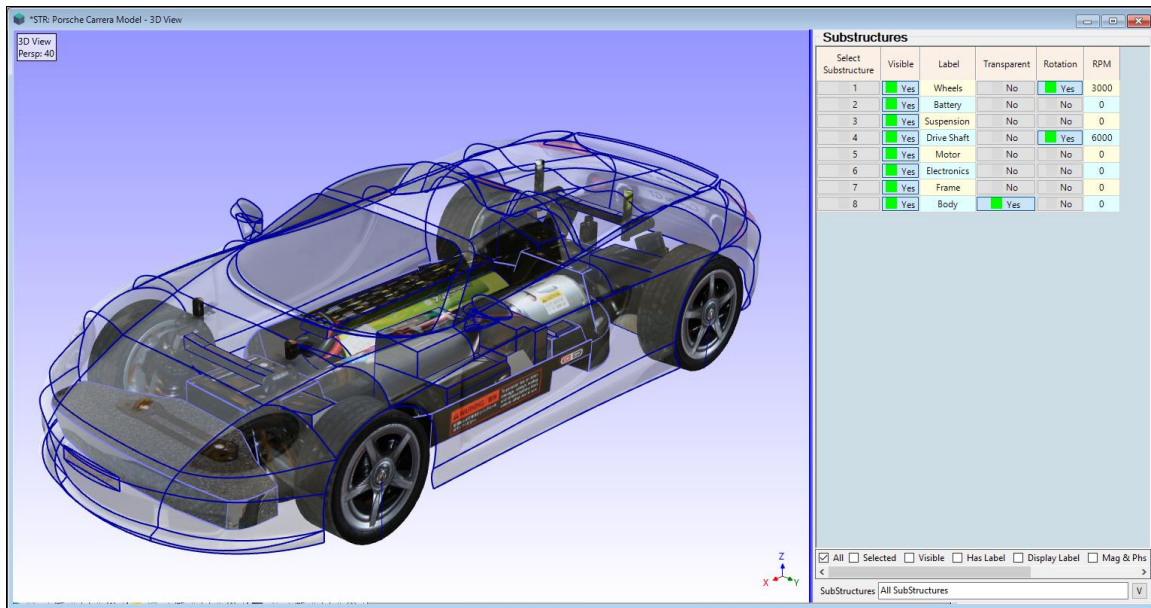
## Substructures Spreadsheet

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** from 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.

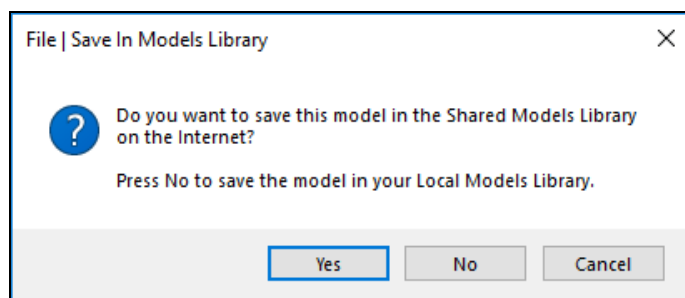
### **File | Save Structure As**

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 MEscape. **Click** on the **Models Library** link on the MEscape **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.

<b>MEscope File</b>	<b>Type of Data</b>	<b>UFF Data Type</b>
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

MEscope 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***

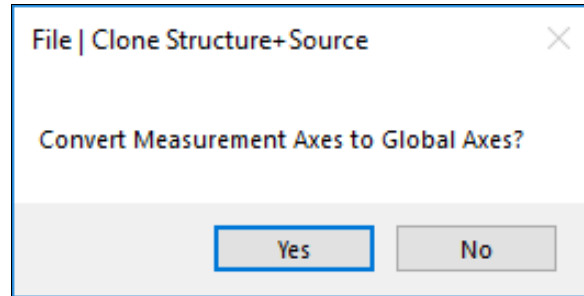
Prints the currently displayed **current Objects spreadsheet** on the system printer, or into a PDF file.

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



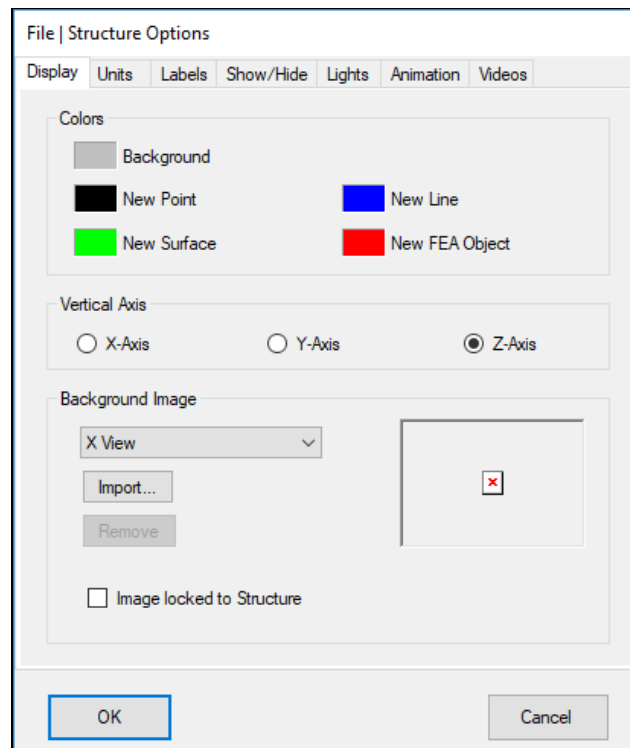
*Measurement to Global Axes Dialog Box.*

- 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

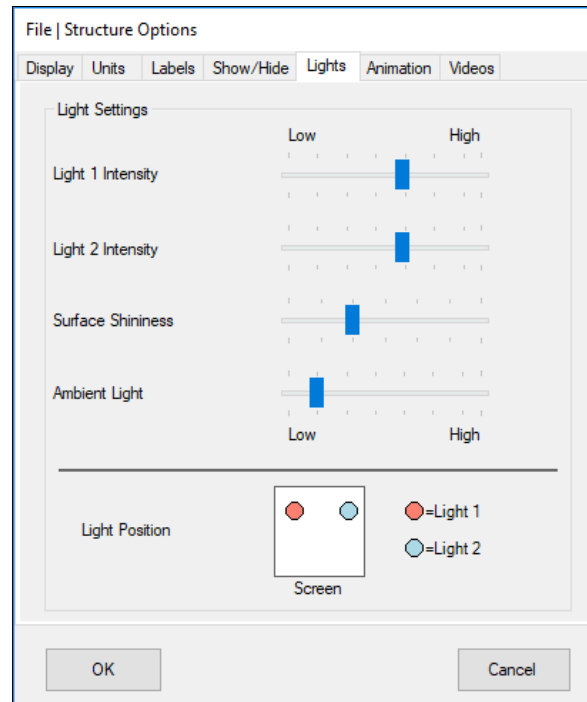
Used for controlling **two surface lights** in the Structure (STR) window.

### Light Controls

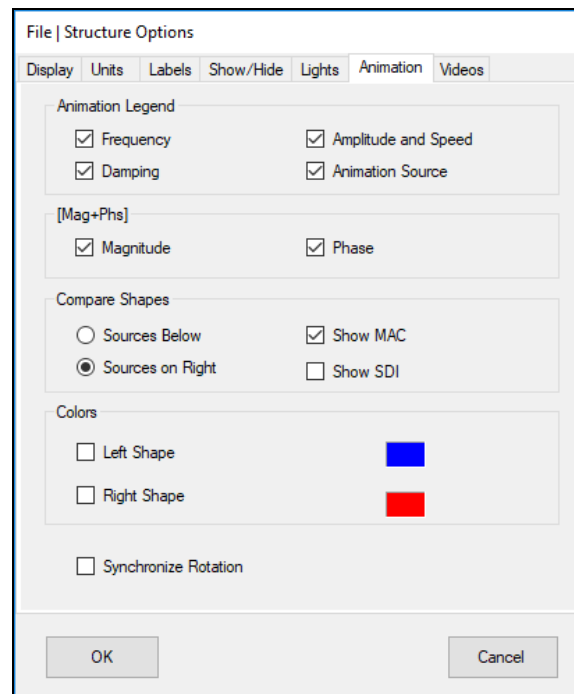
- Adjust the **Intensity** of each light between Low & High
- Adjust the **Shininess** of the structure model **Surfaces** between Low & High
- Adjust the **Ambient light** between Low & High

**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 MEscape 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.

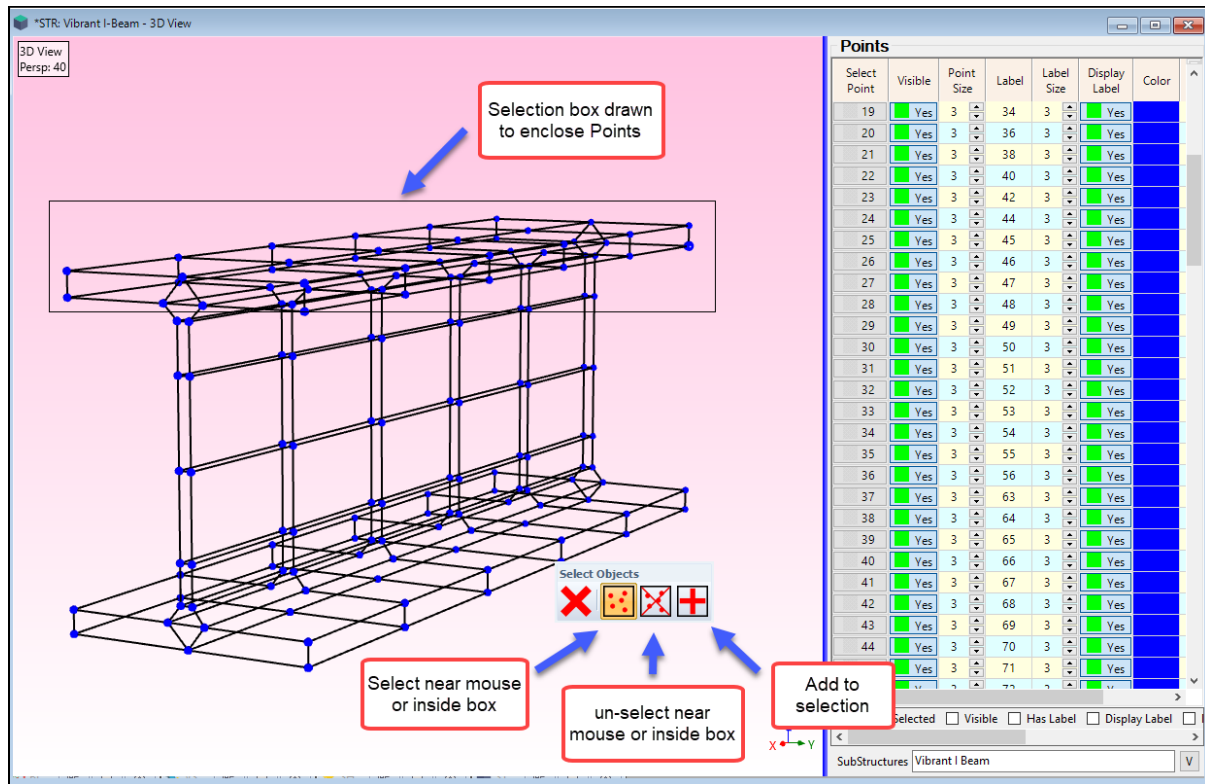
When this command is executed, a **Floating Interactive Selection Control** opens in the current View as shown below.

**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

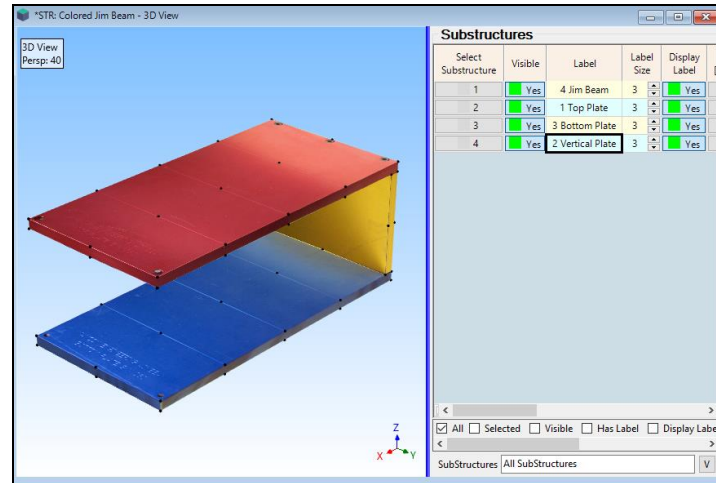
Sorts (re-orders) Objects in the rows of the *current Objects spreadsheet* according to their Labels.

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

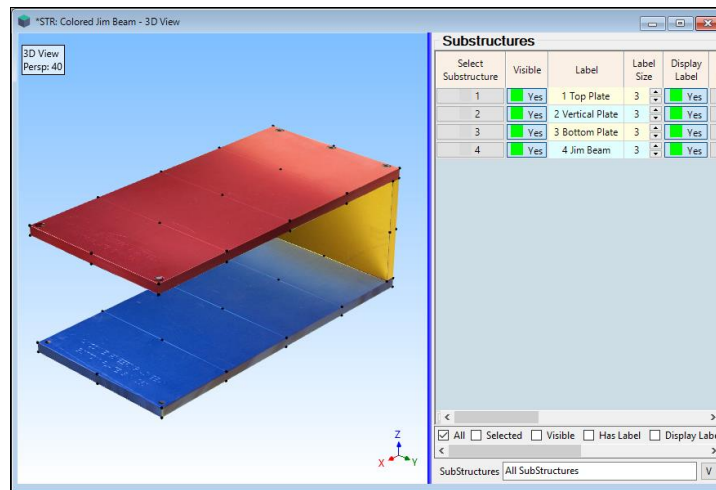
Objects are sorted in the following order

- 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 **uplicated** 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 <i>checked</i> , the Structure (STR) window is in the <b>Drawing state</b> .
---

#### *Draw / Drawing Assistant*

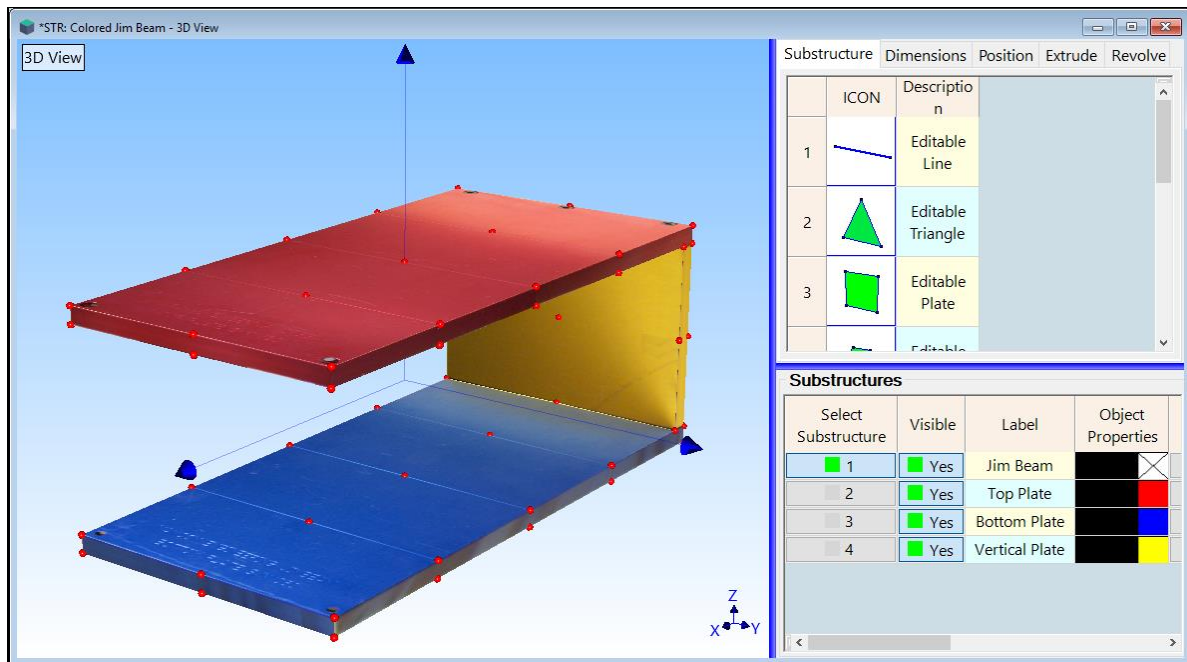
Shows or Hides the **Drawing Assistant** tabs above the **Substructures** spreadsheet in the Structure (STR) window, as shown below

#### 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

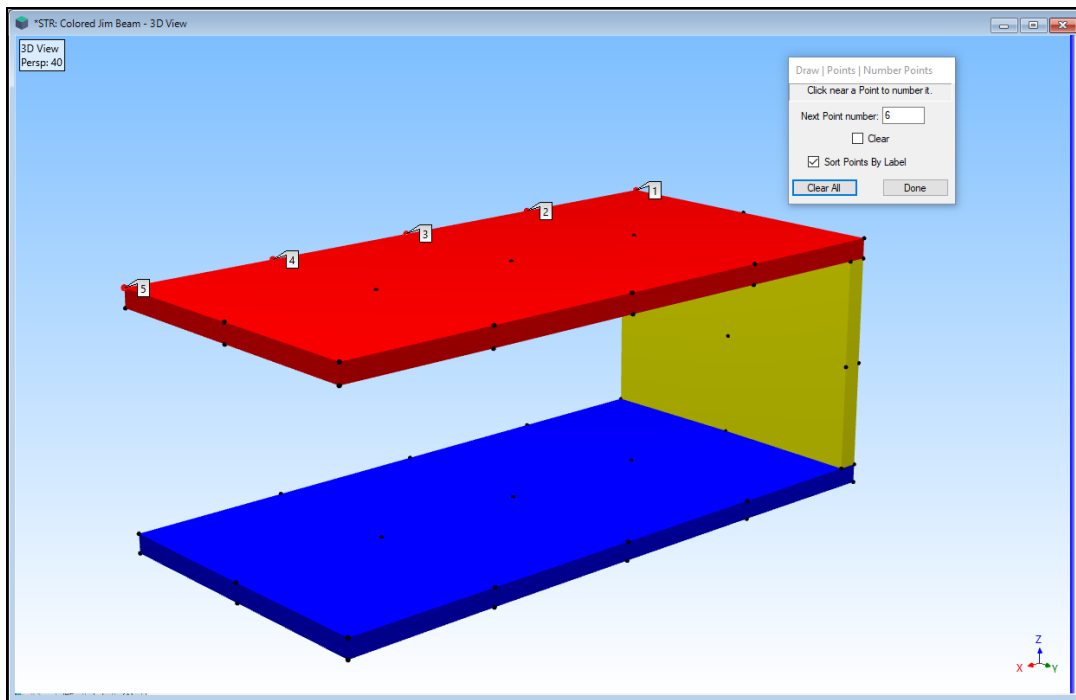
Used to *number* the Points on a structure model by *clicking near each Point*.

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

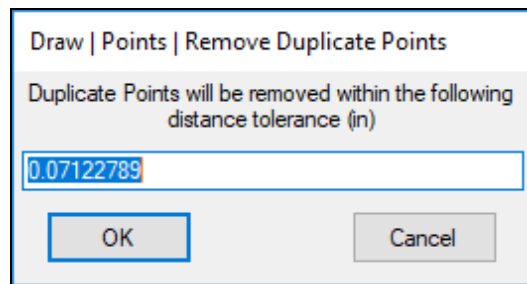
**Draw / Points / Remove Duplicate Points**

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

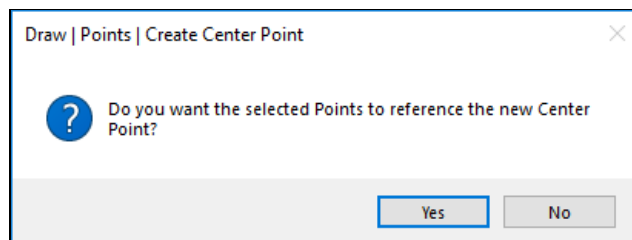
- Enter a distance tolerance for removing duplicate Points and click on OK

**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**.

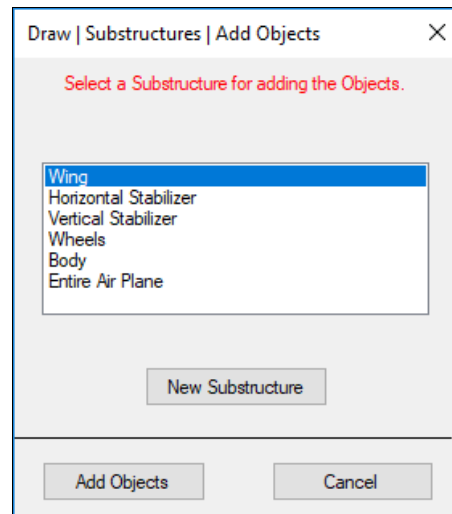
If you **click on No**, the new Point **will not be added** to the **Center Point** column of the **selected Points**.

**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



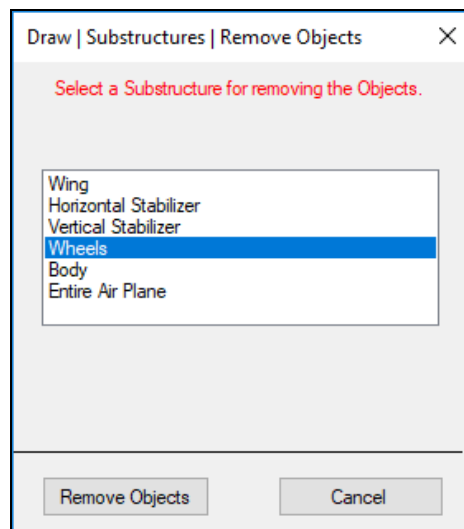
- Choose an existing Substructure and **click on Add Objects**
- Or **click on New Substructure** to create a new substructure that references the selected Objects.

***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

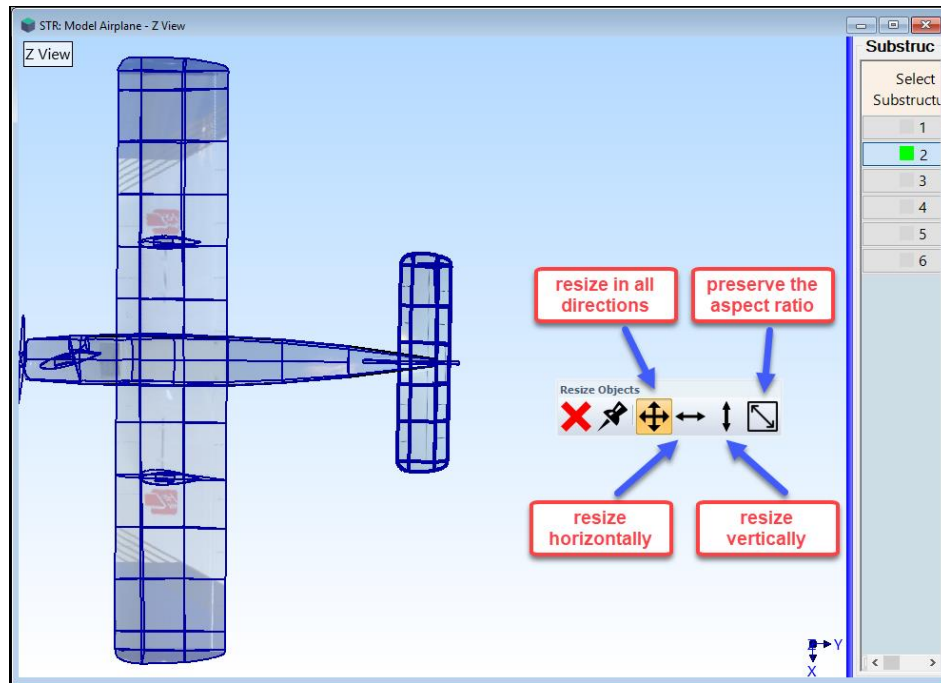


- Choose an existing Substructure from which to remove the **selected** Objects, and **click on Remove Objects**

**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**

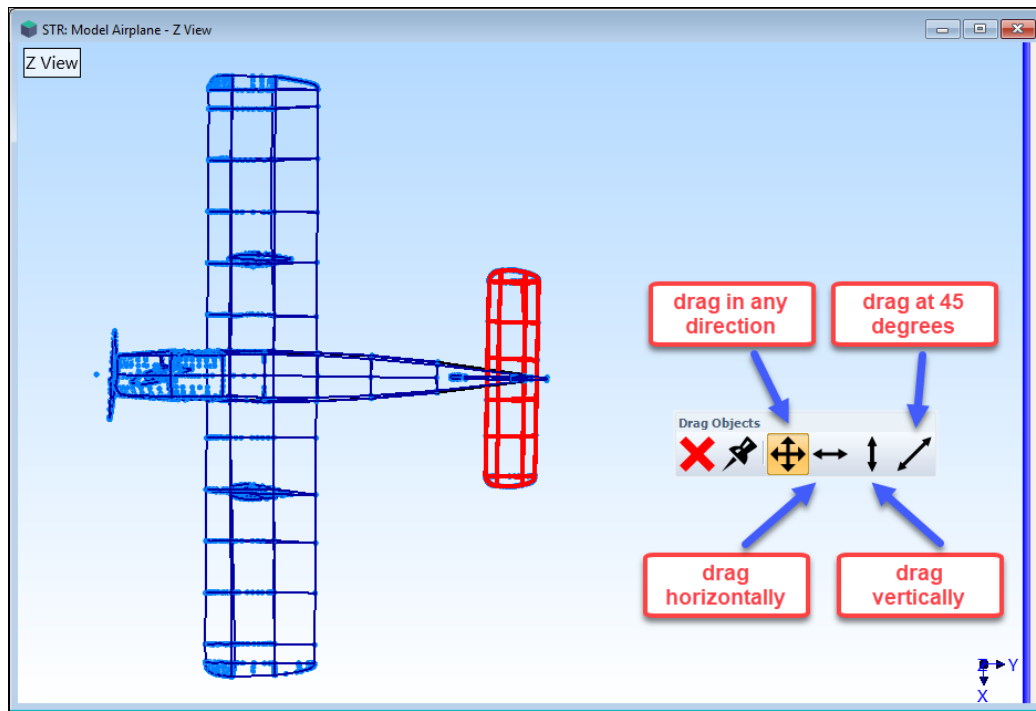
- Select Points with ICONs assigned to them in the **ICON** column of the **Points** spreadsheet
- Execute **Draw | Resize Objects** and **click on Yes** in the dialog box that opens

**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.*

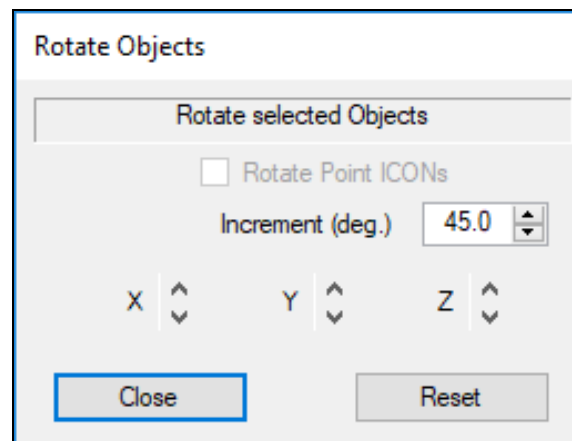
### **Draw / Rotate Objects**

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

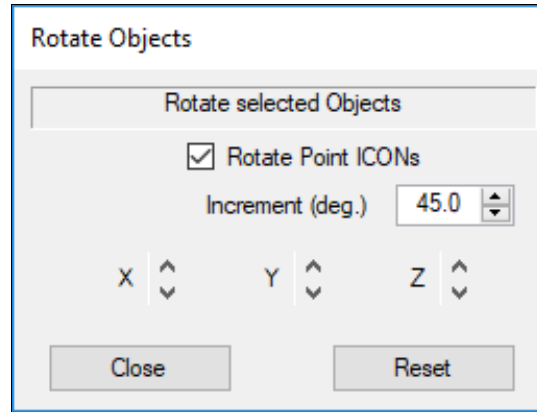
- Enter the rotational Increment (in degrees)
- **Click** on one of the **Up/Down** Vectors next to the axis about which to rotate the selected Objects



*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**

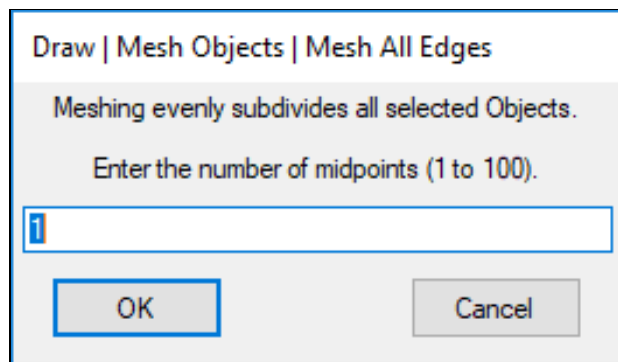
Subdivides the edges of *all (or selected) Objects* using *evenly spaced* midpoints.

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

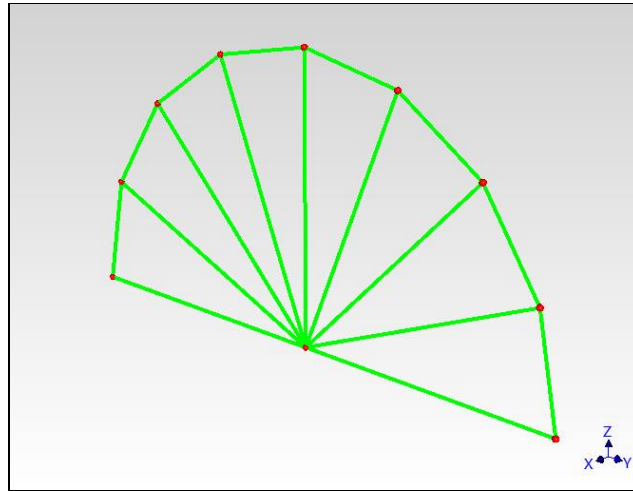


The **number of midpoints** is the number of Points that will be added between the endpoints of each Line or Surface edge.

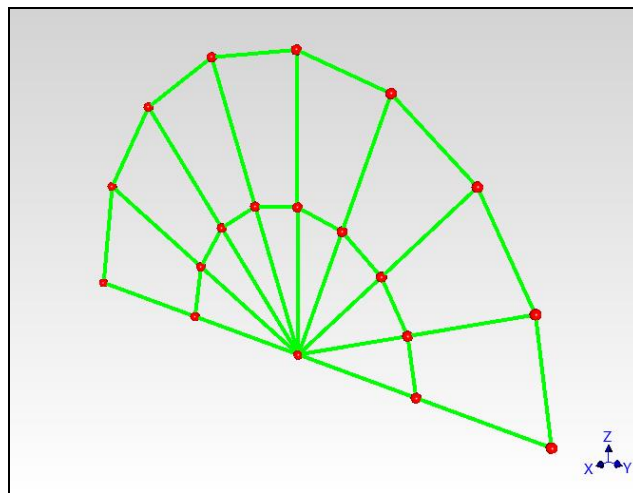
### **Draw / Mesh Objects / Mesh Longest Edges**

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.

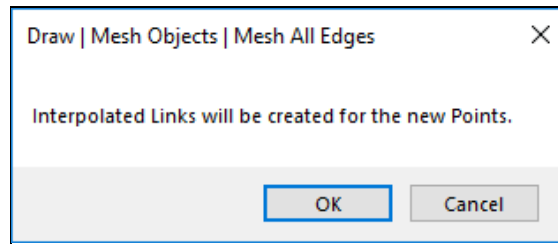
- **Select** the Objects to be meshed and Execute **Draw | Substructures | Add Objects**
- **Click** on **New Substructure** in the dialog box and enter a name for the new Substructure
- **Select** the new Substructure and mesh it

### **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

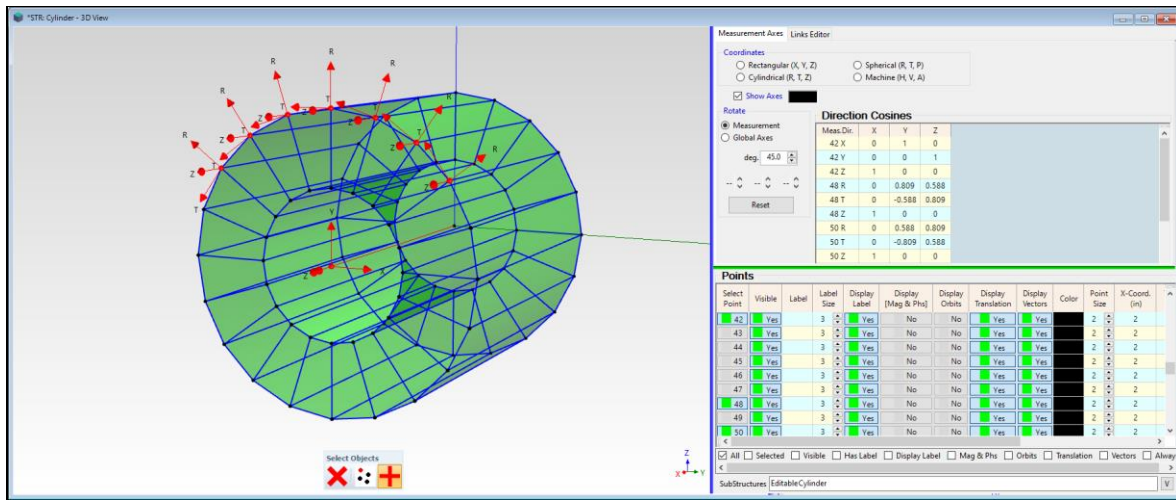
Opens and closes the **Measurement Axes** tab, as shown below.

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**.

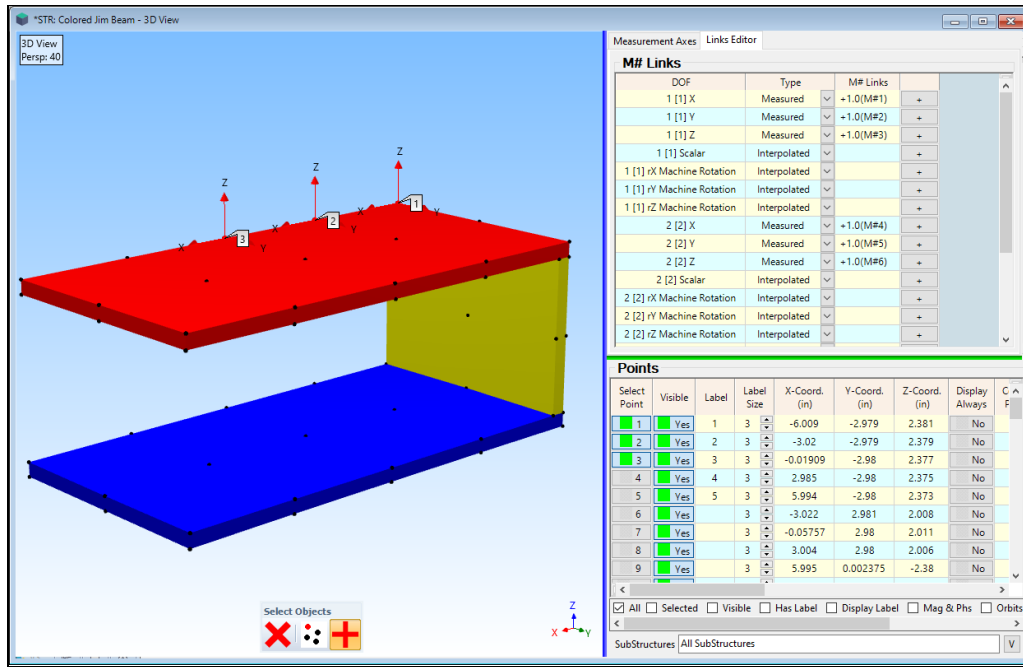
### Reset button

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) window 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**.

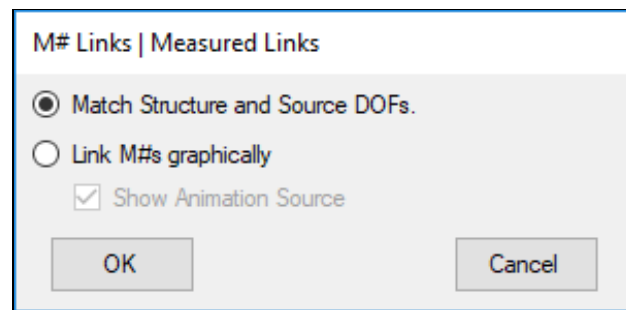
Machine rotational data is animated by displaying the **rigid body rotation** of all **Radial Points** about a referenced **Center Point**.

### **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.

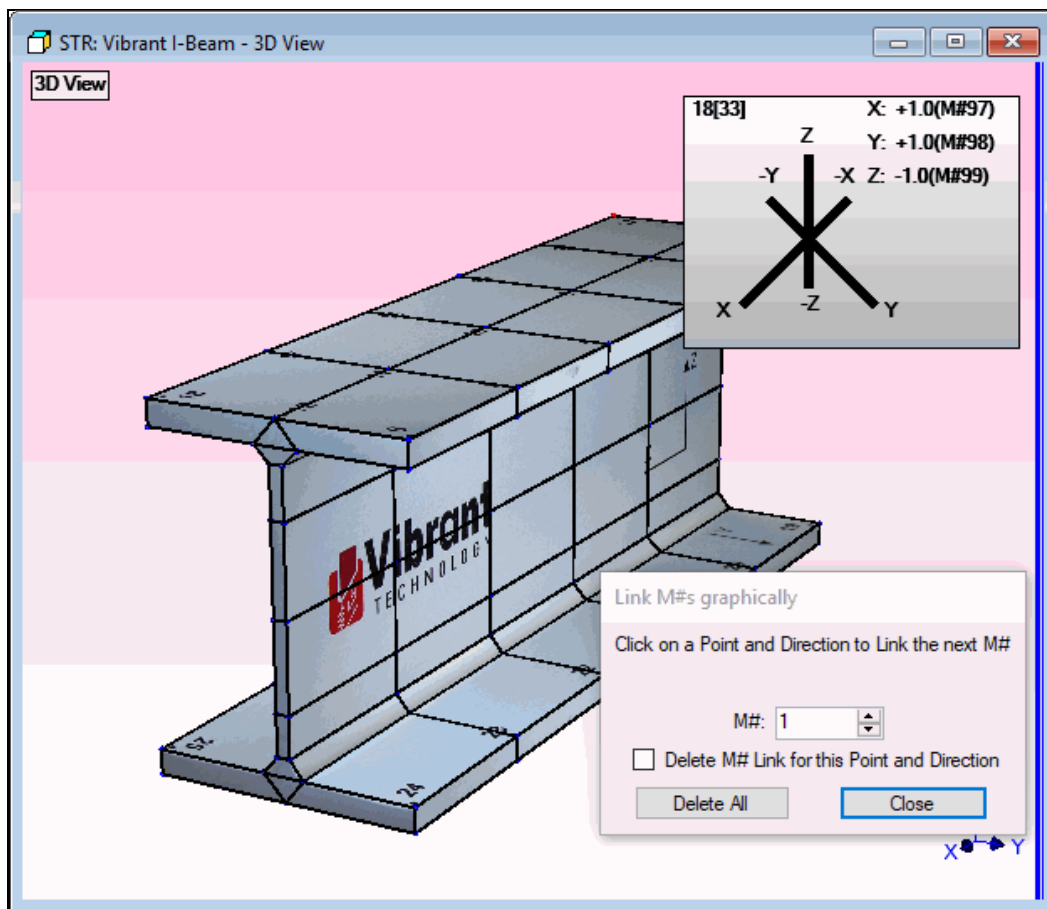
## Measured Link Creation

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*

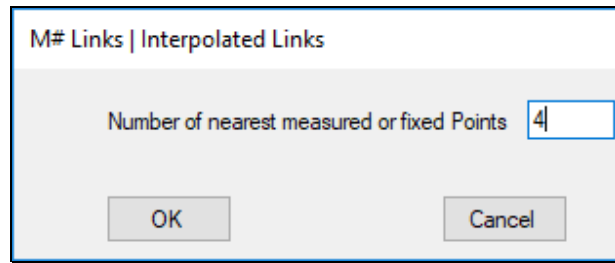
**Hint:** It is a good practice to *select Points* and create **Interpolated Links** for *portions of the model at a time*, then Animate a Shape to verify that the **Interpolated Links** provide realistic animation.

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	<b>X, Y, Z</b>
Cylindrical	<b>R</b> (radial), <b>T</b> (tangential), <b>Z</b> (axial)
Spherical	<b>R</b> (radial), <b>T</b> (tangential), <b>P</b> (elevation)
Machine	<b>H</b> (horizontal), <b>V</b> (vertical), <b>A</b> (axial)

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



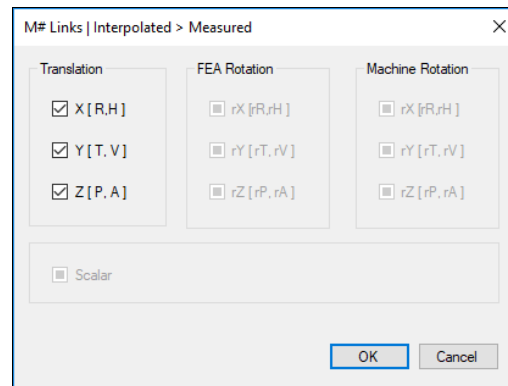
### *M# Links / Interpolated > Measured*

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



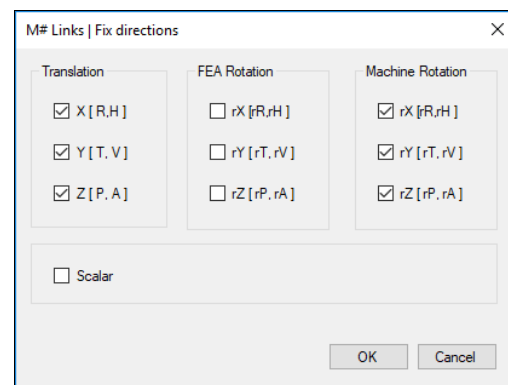
- *Check* the Measurement Axes directions for converting the Interpolated Links and *click* on OK

### *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*

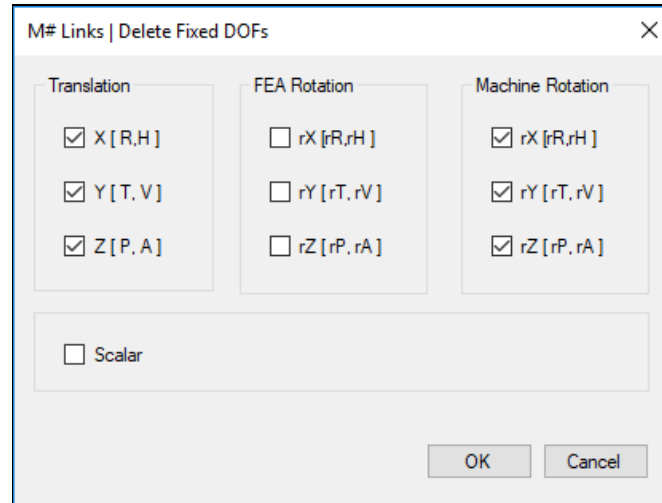


### ***M# Links / Delete Fixed DOFs***

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***



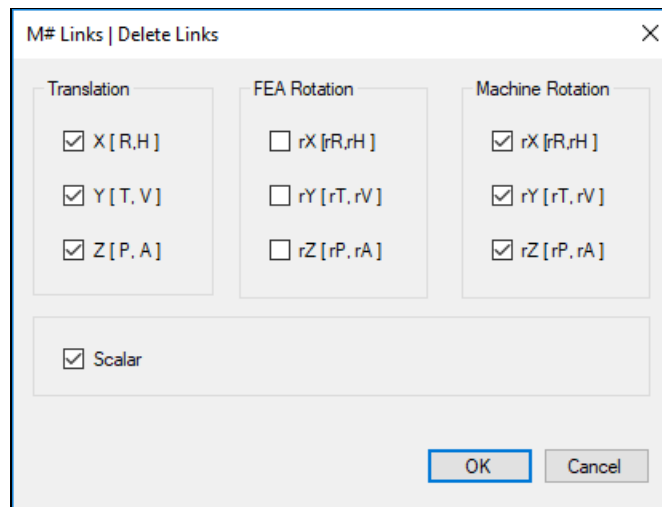
The dialog box titled "M# Links | Delete Fixed DOFs" contains three columns of checkboxes. The "Translation" column has three checked boxes: X [R,H], Y [T,V], and Z [P,A]. The "FEA Rotation" column has three unchecked boxes: rX [rR,rH], rY [rT,rV], and rZ [rP,rA]. The "Machine Rotation" column has three checked boxes: rX [rR,rH], rY [rT,rV], and rZ [rP,rA]. Below these columns is a "Scalar" checkbox which is unchecked. At the bottom right are "OK" and "Cancel" buttons.

### ***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.

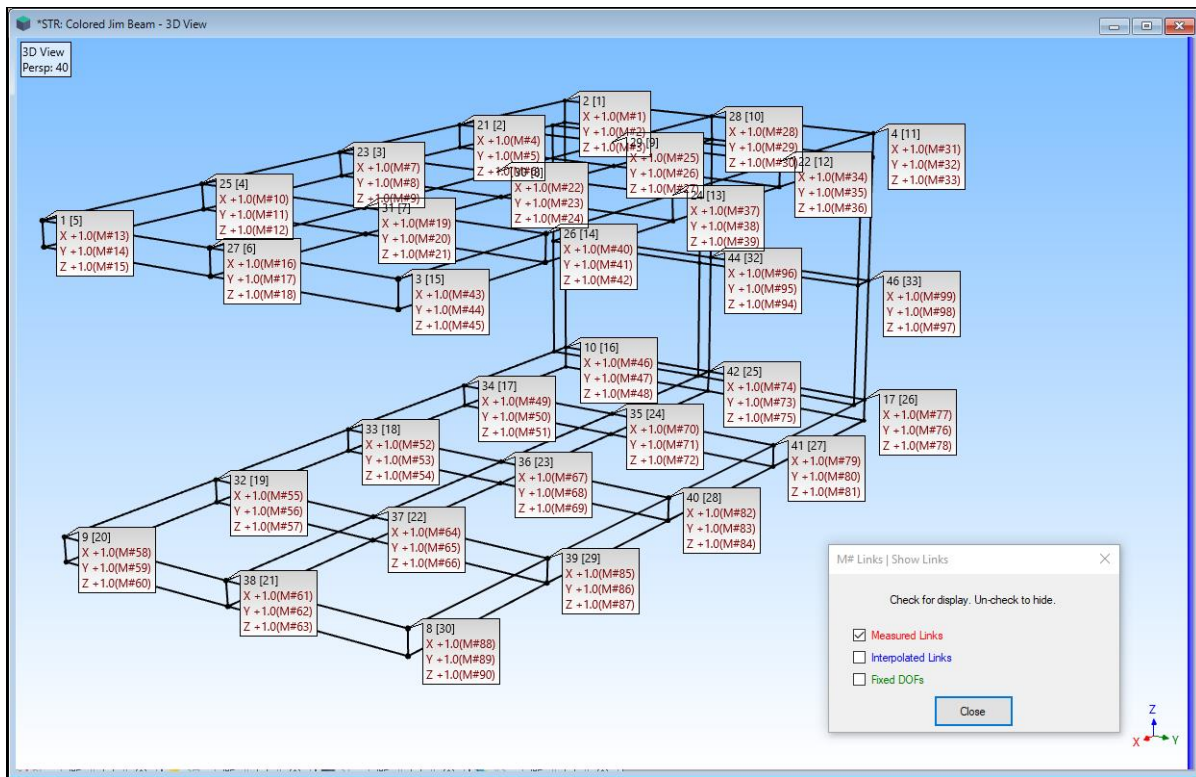
- ***Select*** the Measurement Axes directions for deleting ***M# Links*** and ***click on OK***



The dialog box titled "M# Links | Delete Links" contains three columns of checkboxes. The "Translation" column has three checked boxes: X [R,H], Y [T,V], and Z [P,A]. The "FEA Rotation" column has three unchecked boxes: rX [rR,rH], rY [rT,rV], and rZ [rP,rA]. The "Machine Rotation" column has three checked boxes: rX [rR,rH], rY [rT,rV], and rZ [rP,rA]. Below these columns is a "Scalar" checkbox which is checked. At the bottom right are "OK" and "Cancel" buttons.

**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 *selected*) Points.

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

**Interpolated Links**

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

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

**Fixed DOFs**

If *checked*, Fixed directions are displayed at *all* (or *selected*) 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 *selected*) 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.

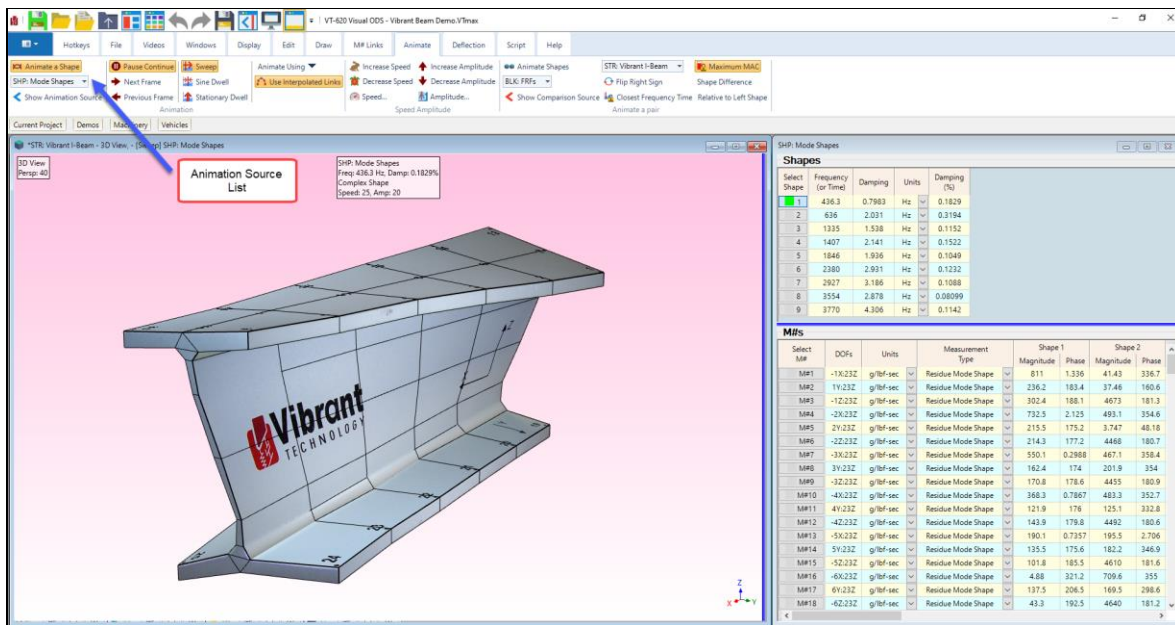
The *current Animation Source* can be a Data Block (**BLK**), Shape Table (**SHP**), or Acquisition (**ACQ**) window.

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 is 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.

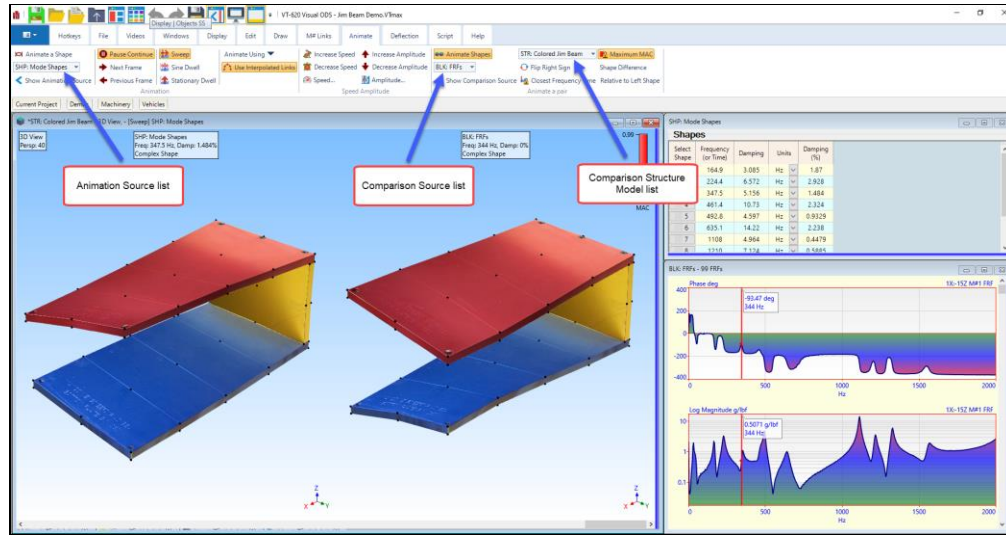
### Animate / Animate a Pair Menu

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**

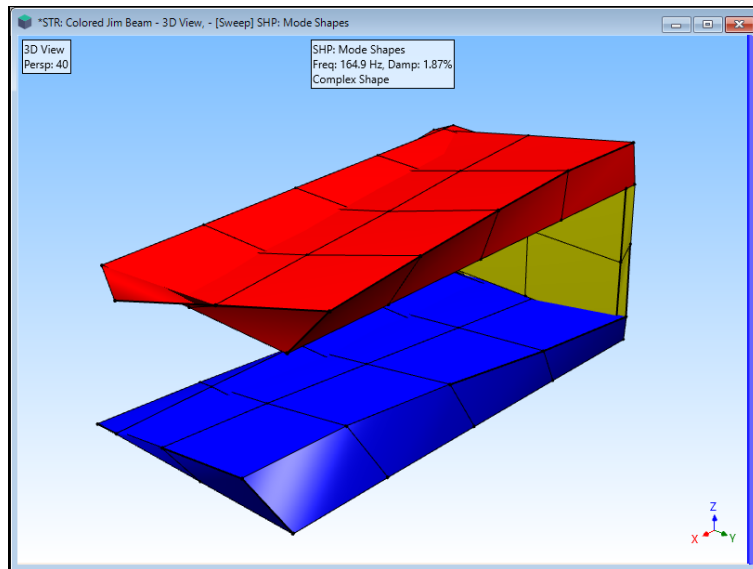
**Animate / Animate a Pair / Relative to Left Shape**

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

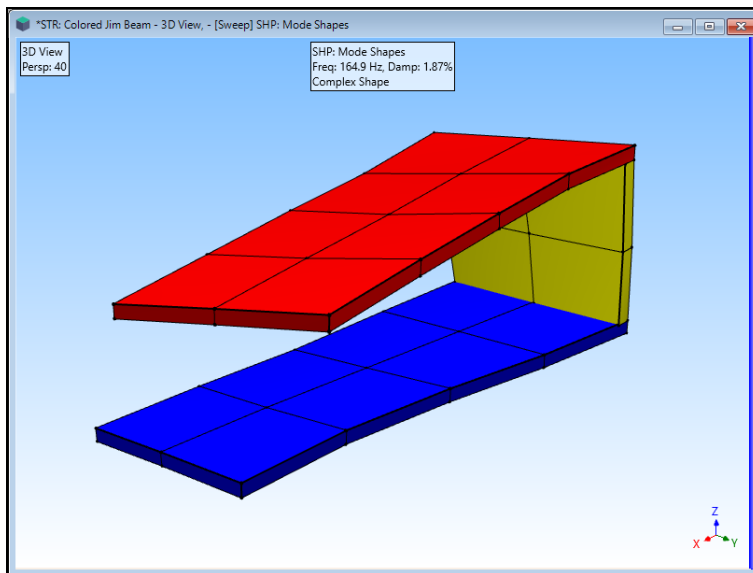
**Animate / Use Interpolated Links**

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.

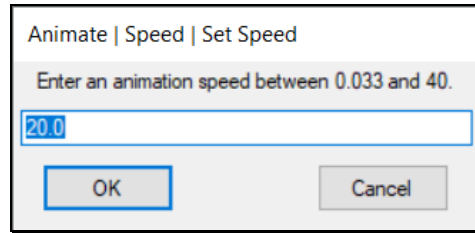
- Dwell speed = **4** → *four sine values per cycle* are used
- Dwell speed = **N** (**N > 4**) → *N sine values per cycle* are used

### **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.

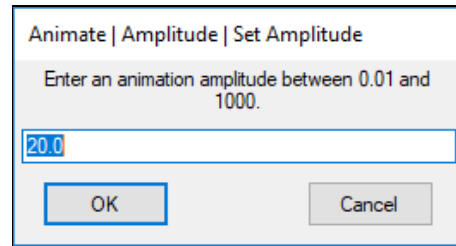


### *Animate | Speed | Increase or Decrease Speed*

- **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

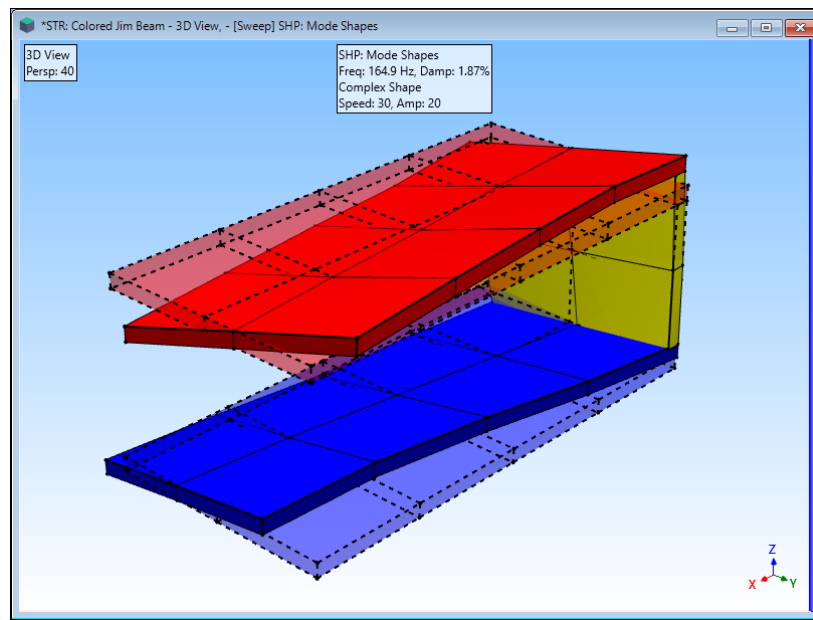
### *Amplitude | Increase or Decrease Amplitude*

- **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

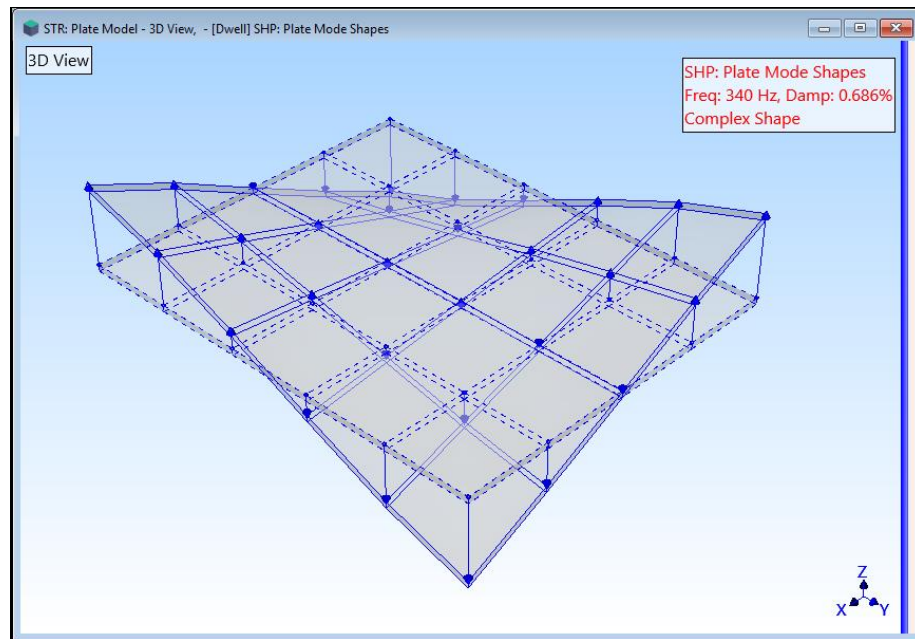
If *checked*, the structure is *deflected* during animation using **translation** data from the *current Animation Source*.

### 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.*

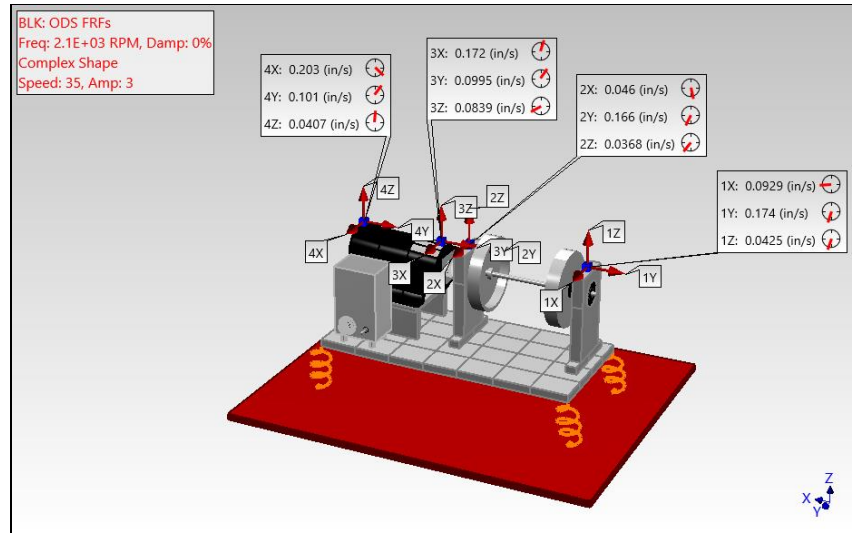
### Deflection / Orbits

- 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.

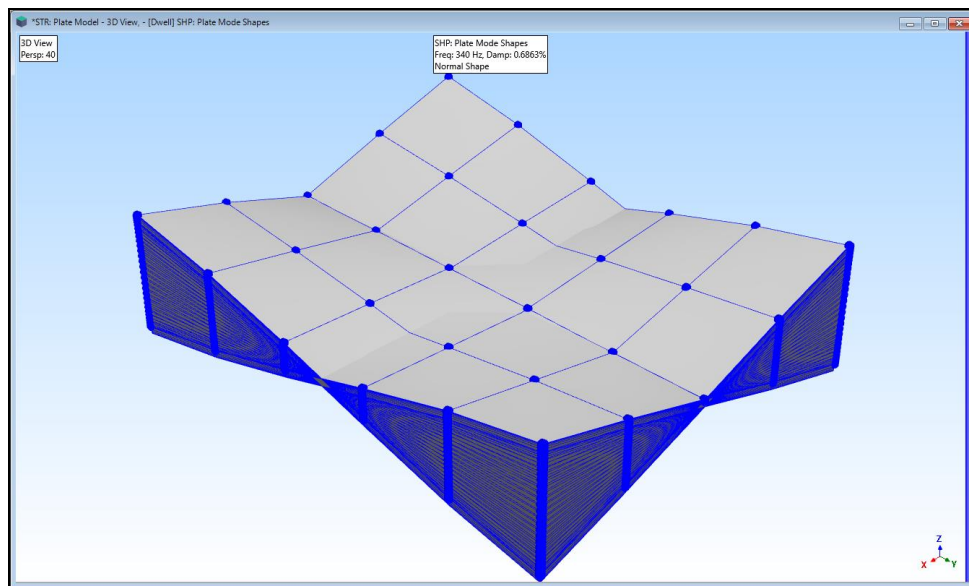


*Shape [Mag & Phs] Displayed at Selected Points.*

### Deflection / Persistence

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

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



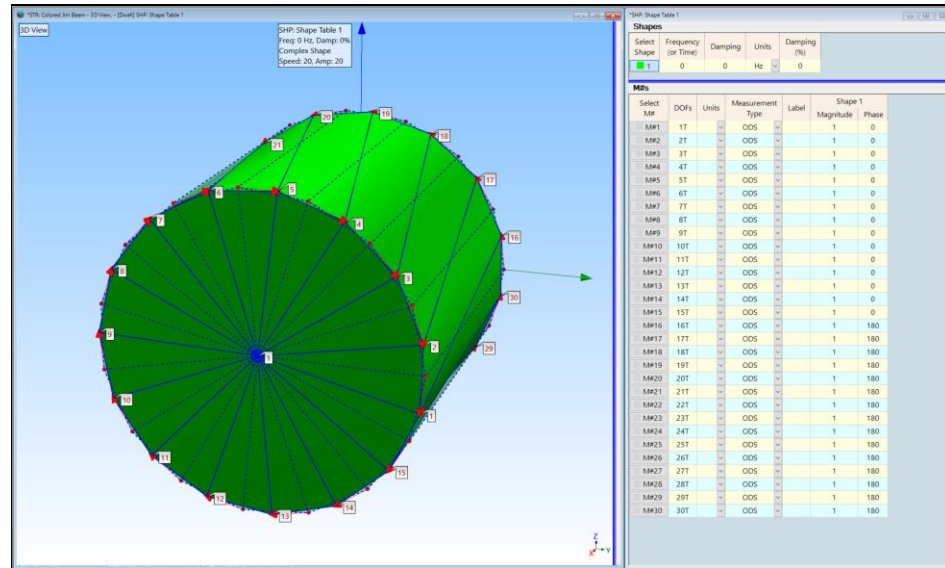
*Sine Dwell Animation with Persistence.*

### 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*

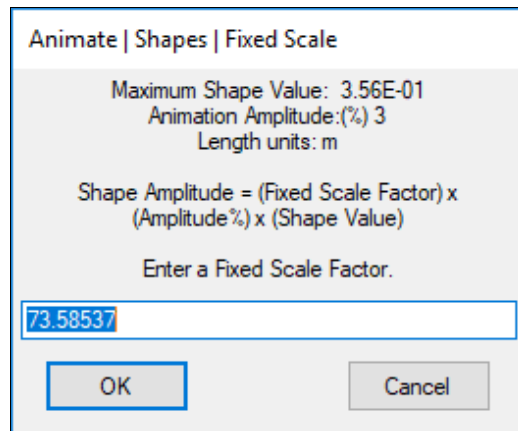
When checked, each shape is divided by the maximum of all **M#** data in the current Animation Source

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 →  $(0.20 \times 100) / (1 \times 10) \rightarrow 2$

### 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

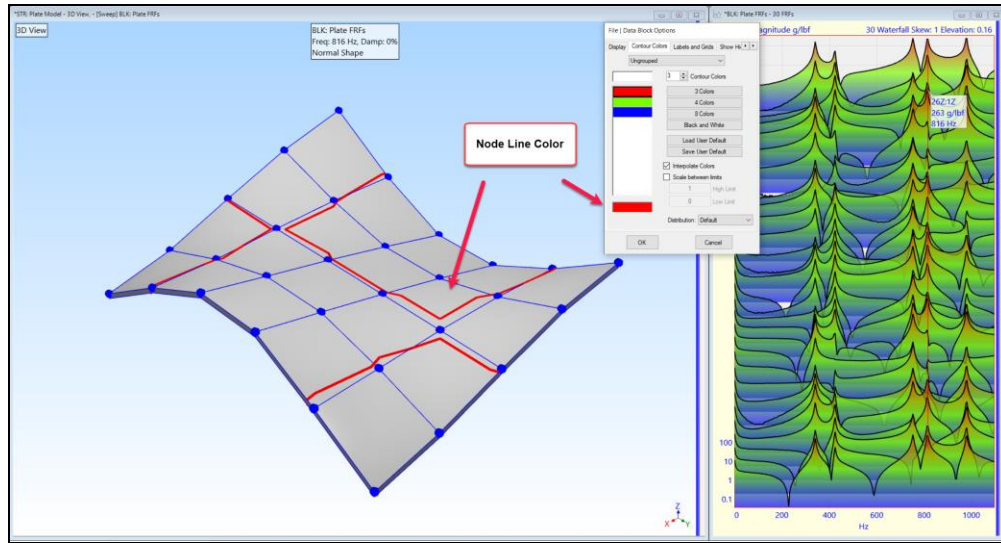
If *checked*, **Node Lines** are displayed on the surfaces of the surface model during shape animation

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.

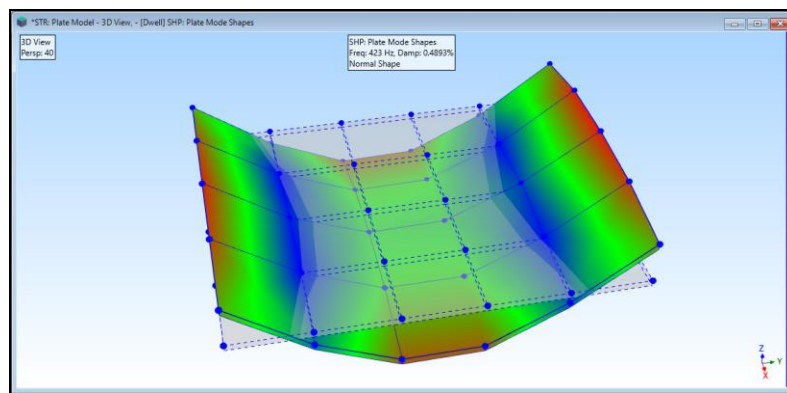


*Node Line Color Taken From BLK Options Box.*

### **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.

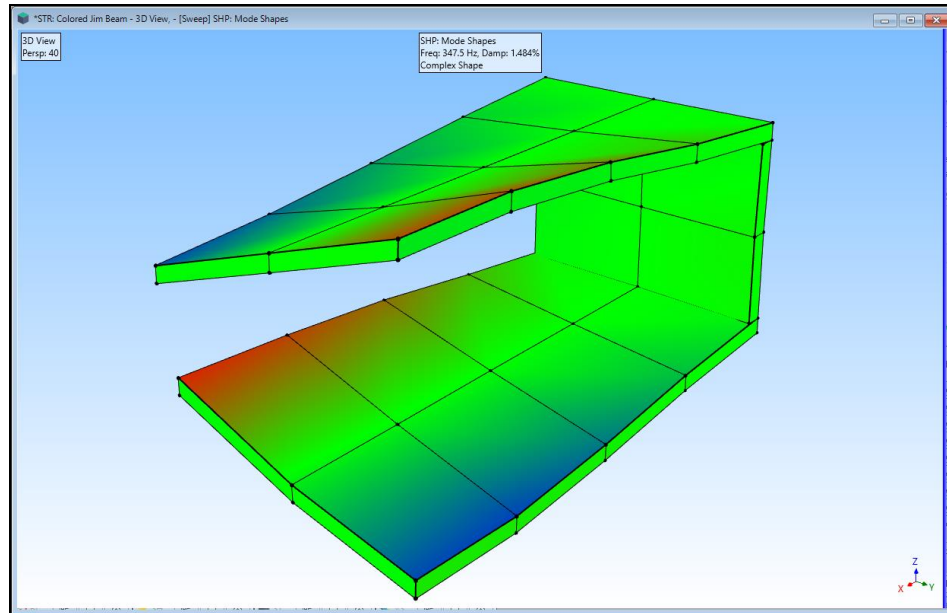
### **Deflection / Contours / Surface Normals**

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,

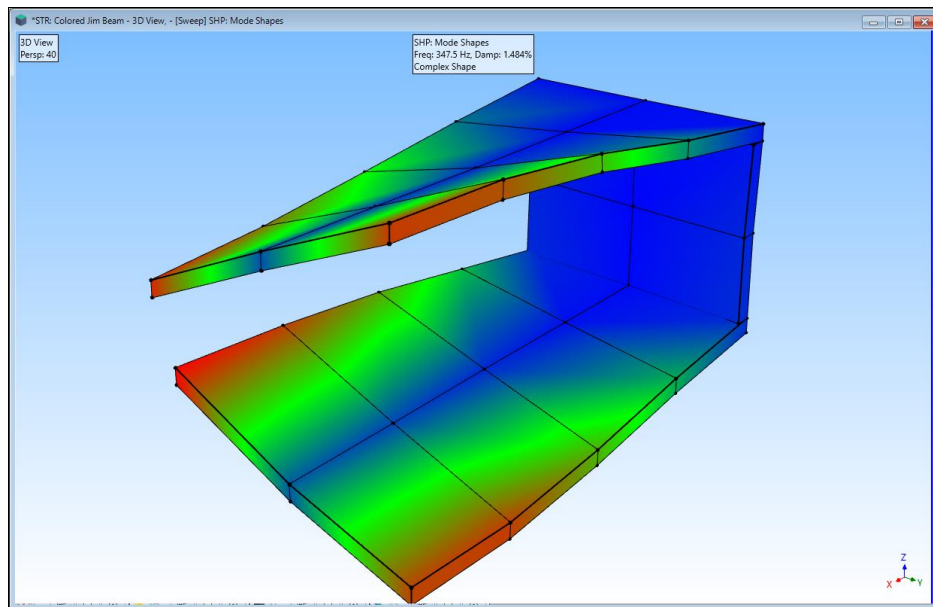
- Execute **Deflection | Contours | Contour Colors**
- Execute **Deflection | Contours | Color Key**
- Execute **Deflection | Contours | Surface Normals**
- The **Color Key** shows one color for *"positive"* and a different color for *"negative"* values, as shown below



*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 [Radial Horizontal]** direction are displayed.

### **Deflection / Y [T V]**

If **checked**, shape values in the **Measurement Axes Y [Tangential Vertical]** direction are displayed.

### **Deflection / Z [P A]**

If **checked**, shape values in the **Measurement Axes Z [Phase Axial]** 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