




Altair

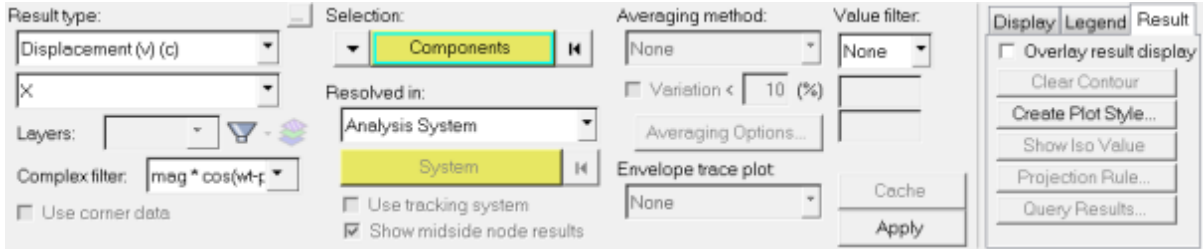
HyperWorks

Altair HyperView 2019 Tutorials

HV-3035: Post Processing Complex Results in HyperView

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Complex results are supported in HyperView and can be animated using the **Modal Animation Mode**, . After switching the animation mode to modal, an additional option appears in the **Contour** panel which allows the users to set the Complex filter.

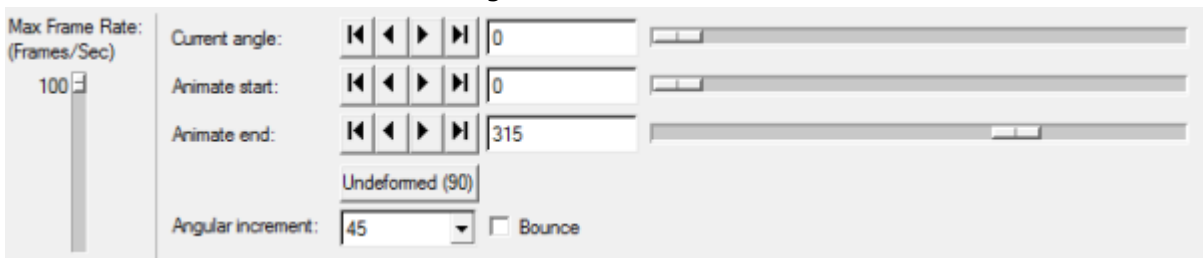



The **Complex filter** selections available are:

- **mag*cos(ωt-phase)** The response with varying angle or ωt (in degree).
- **mag** Magnitude (r) of the complex result.
- **phase** Phase (φ) of the complex number.
- **real** Real part (x) of the complex number.
- **imaginary** Imaginary part (y) of the complex number.

Results that are complex are shown in the **Result type list** with a **(c)** appended to the result name. The other selections in the **Contour** panel are the same for complex results, as they are for non-complex results.

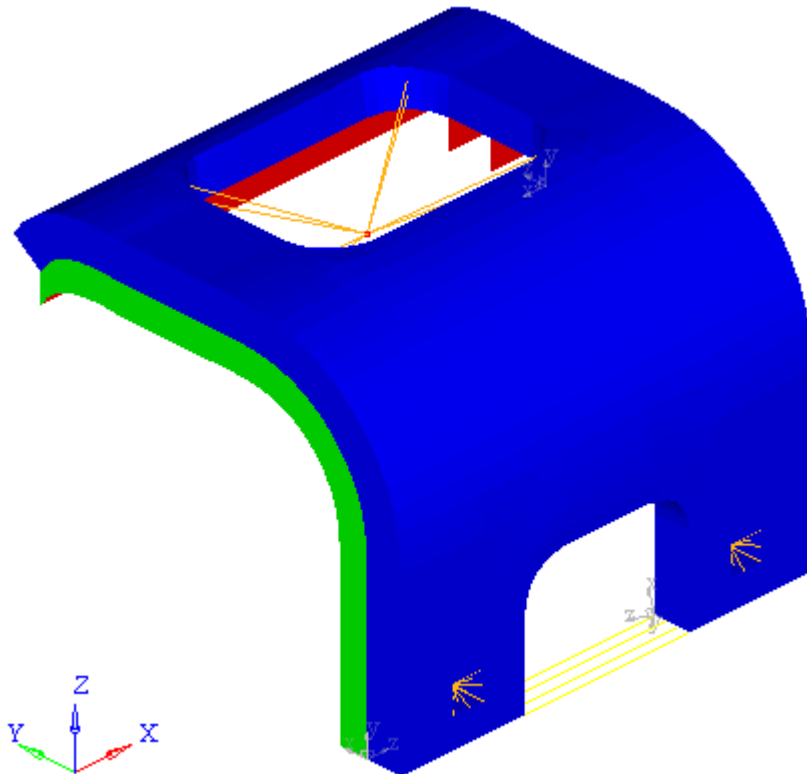
To view the contour of the complex response at a certain angle, use the **Animation Controls** icon . Within the **Animation Controls** panel, use the **Current angle** entry field to enter in the value for the angle.



Also in the **Animation Controls** panel, the **Angular Increment** can also be set. This is used when animating the model (see image above). To start the animation, click on the **Start/Pause Animation** button .



Exercise



The following exercise is an example of how post-processing complex results in HyperView is done. The model used in this exercise has four load cases. The first load case contains the static result. The second load case resets the model to an unloaded structure and is the base state used for load case 3 where the eigenfrequencies are extracted. In load case 4, the response of the mass element (element ID 999) on top of the clip due to a dynamic excitation (frequency dependent load) of the bearing in a node (node id 10000) is analyzed. The model is fixed in all six degrees of freedom at node 9999.



This exercise uses the model file `Postprocessing_demo.inp` and the corresponding results file `Postprocessing_demo.odb`.

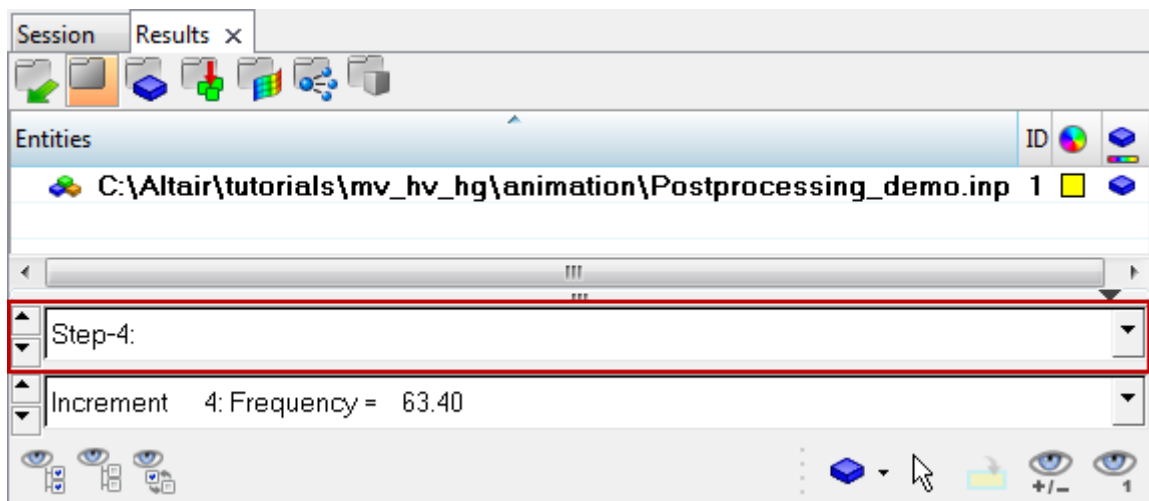
Step 1: Import the model into HyperView and set the animation mode to modal.

1. Click the arrow next to the **Page Window Layout** icon  on the **Page Controls** toolbar, and select the three window layout .
2. Go to the **Load Model** panel by selecting **File > Open > Model** from the main menu.
3. Load the model file `Postprocessing_demo.inp` and the results file `Postprocessing_demo.odb`, located in the animation folder.


4. Verify that the window on the left is the active window (it will have a cyan box surrounding it).
5. Click **Apply** to bring the model and results into HyperView.
6. Click on the downward pointing arrow next to the **Animation Mode Menu** icon  and select  **Set Modal Animation Mode**.

Step 2: Set the load case to load case 4 and contour the model.

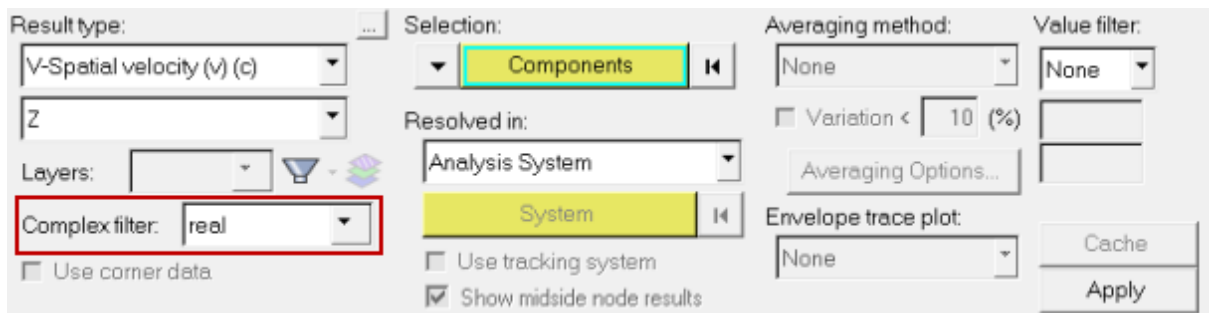
1. From the **Results Browser**, use the **Change load case** drop-down menu to set the load case to **Step-4**.



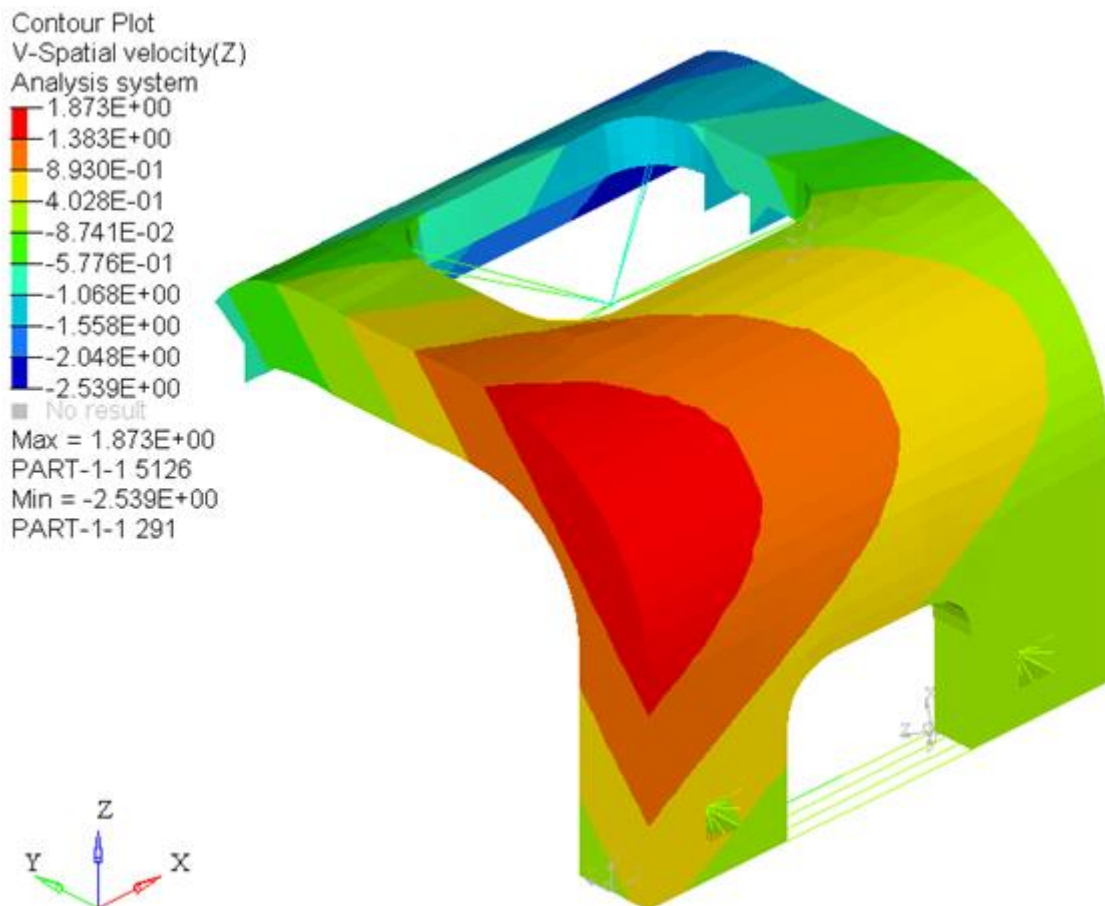
Note The **Change load case** toolbar visibility can be toggled on/off using the **Configure Browser** option (located in the **Results Browser** context menu).

2. Use the second drop-down menu to set the simulation to **Increment 4: Frequency = 63.40**.
3. Click the **Contour** panel button  on the **Result** toolbar to enter the **Contour** panel.
4. Click on the drop down for **Result type**. Notice that all available options are **vectors (v)** and they are all also **complex (c)**. Select **V – Spatial velocity (v) (c)** which is the global velocity.
5. Under **V – Spatial velocity (v) (c)** click on the drop down menu and select **Z** to select the z component of velocity.

- Notice that the **Complex filter** field is activated. Click on the drop down and select **real** to contour the model with the real component of the velocity in the global z direction.






- Click **Apply**.




- Repeat steps 6 and 7, this time setting the **Complex filter** to **imaginary** to contour the imaginary component of the velocity.
- Continue to repeat steps 6 and 7, setting the **Complex filter** to **mag** to contour the magnitude of the velocity and then phase to contour the phase of the velocity.
- Set the **Complex filter** to **mag*cos(wt-phase)**. This contours the response with varying angle or wt (in degrees). This filter will be used to animate the model.
- Set the **Resolved in** system to **Global System** and click **Apply**.

Step 3: Set the animation parameters and animate the model.

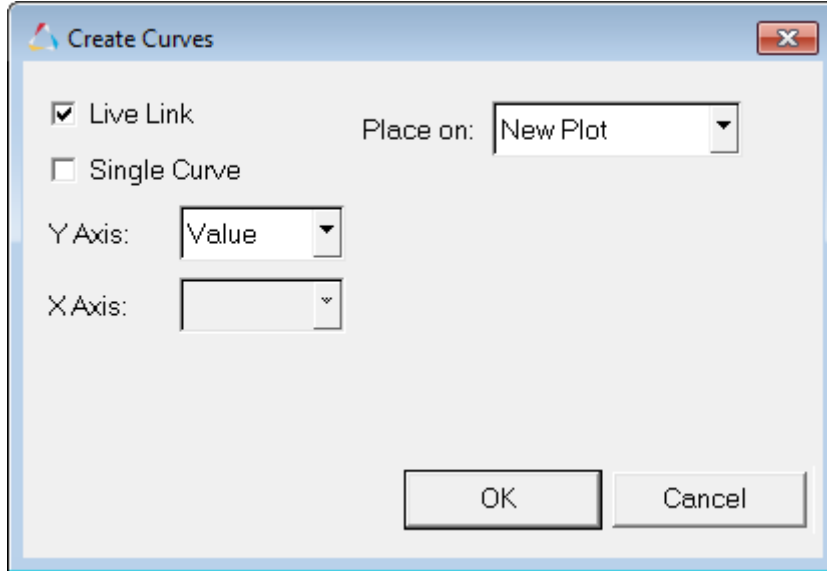
1. Click on the **Animation Controls** button .
This panel allows users to set the **Current angle** of the animation and also the **Angular Increment** of the animation.
2. For **Angular Increment**, select **15**.
3. Click on the **Start/Pause Animation** button  to start the animation.
4. Set the **Max Frame Rate** (on the left side of the panel) to **10**. This will slow down the animation.
Notice how the values for the **Current angle** are incremented by 15. This is because the **Angular Increment** was set to 15.
5. Click on the **Start/Pause Animation** button  to stop/pause the animation.
6. Use the scroll bar for the **Current angle** to set the current angle to **0**.

Step 4: Create a measure of the nodal value at node 999 and plot the values.

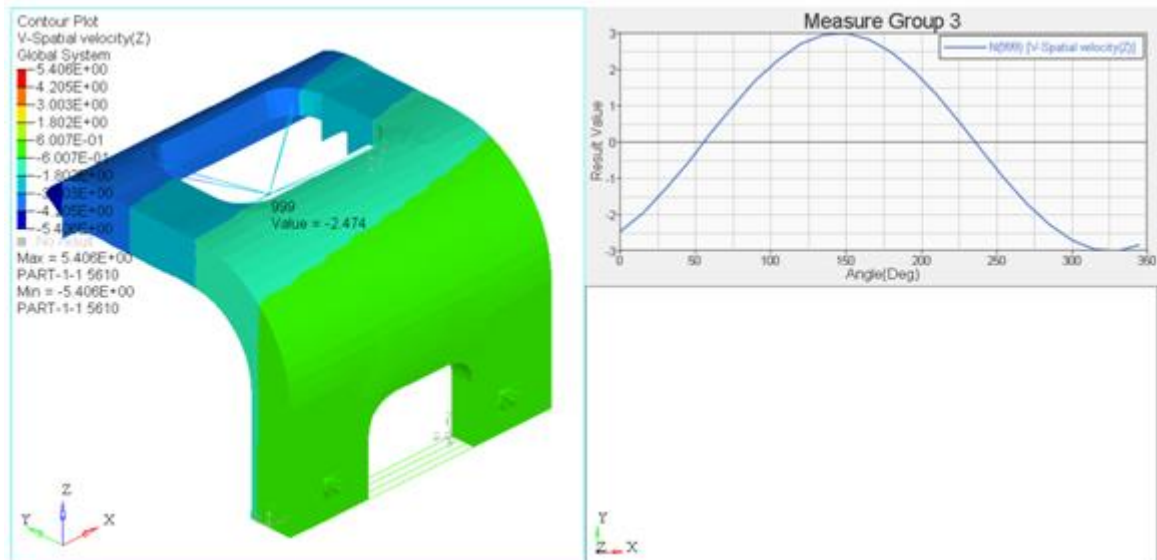
1. Click the **Measure** panel button  on the **Annotation** toolbar to enter the **Measure** panel.
2. Click on **Add** to create a new measure.
3. From the drop down menu, select **Nodal Contour**.
4. Click on the yellow **Nodes** input collector and pick **By ID**.
The **Select by ID** dialog is displayed.
5. Enter in the value 999 to select the node with the ID of 999. Click **OK**.
This adds a measure at node 999. As displayed in the graphics area, the value at angle 0 is -2.474.
6. On the right side of the panel, click on the **Create Curves** button.
The **Create Curves** dialog is displayed.
7. From the **Place on** drop-down menu, select **New Plot**.
8. From the **Y-Axis** drop-down menu, select **Value**.

- Check the option for **Live link**.

The **Live link** option creates a link between the selections made on the measure panel and the curve. When a live measure item is deleted, a message is displayed prompting you to either keep or delete the curve.



- Click **OK**. This creates a curve in the second window which has the phase angle in degrees on the x-axis and the measure value on the y-axis.




In HyperView, the formula used to create this plot is:

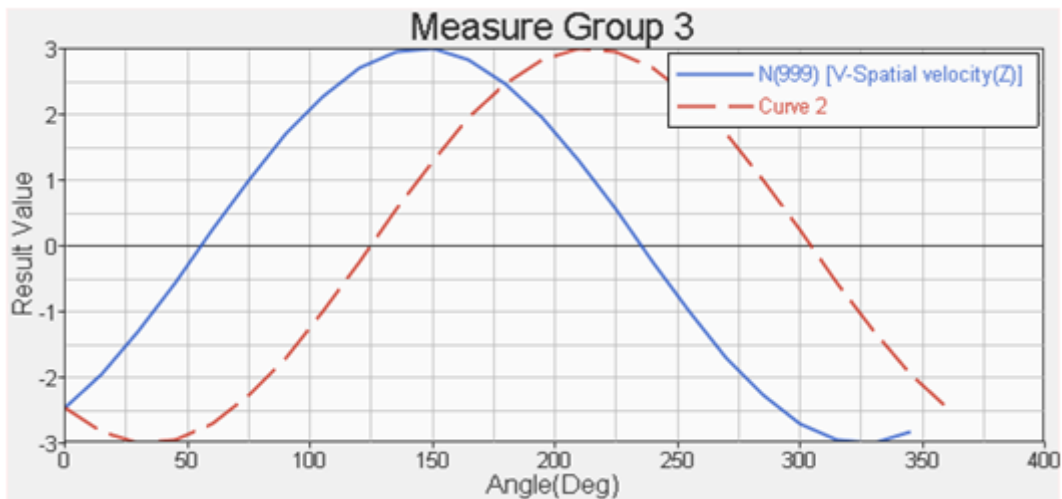
$$\text{real} * \cos(\omega t) + \text{imaginary} * \sin(\omega t)$$

Not all post processors use this equation though. Another possible equation used by other post processors is the following:

$$\text{real} * \cos(\omega t) - \text{imaginary} * \sin(\omega t)$$

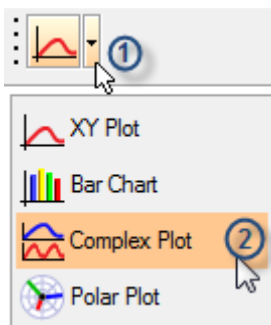
Notice the slight difference in the equations. Next you will plot this second equation on the same plot as the measure curve to illustrate that the difference between the two is simply a phase shift.



11. Click on the second window in the session to make it the active window.
 12. Click the **Define Curves** panel button  on the **Curves** toolbar to enter the **Define Curves** panel.
 13. Click on **Add** to create a new curve.
 14. For **x=**, select **Math** as the **Source** and then enter the following:
 $0:360:15$
 This creates a vector which starts at 0, ends at 360, and is incremented by 15.
 15. For **y=** select **Math** as the **Source** and then enter the following:
 $-2.474*\cos(x*PI/180)-1.696*\sin(x*PI/180)$
 In the equation above, -2.474 is the real value and 1.696 is the imaginary value.
 16. Click **Apply**.
- Notice that the curves are identical except for the phase shift.

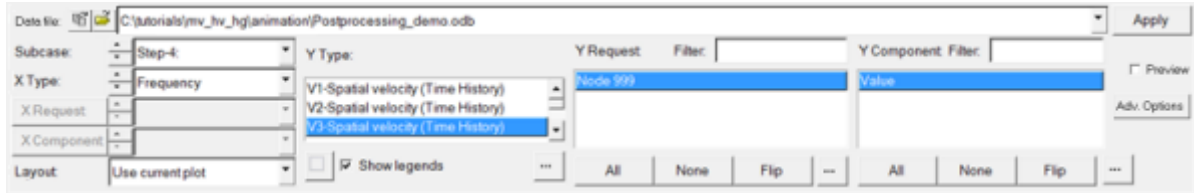


Step 5: Create a complex plot of the time history velocity values.

1. Click on the third window to make it the active window. Change the window type to **HyperGraph 2D**.
2. Set the plot type to **Complex** (see below).

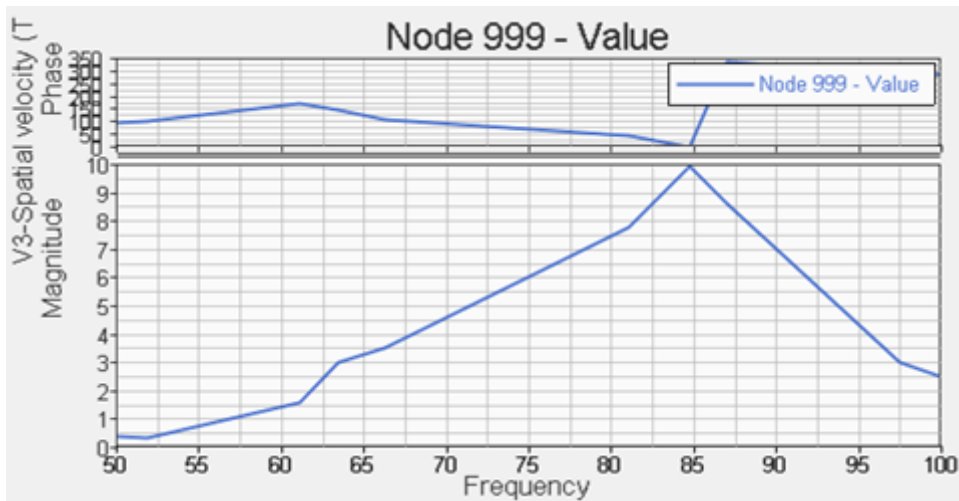


3. Select the **Build Plots** icon  on the **Curves** toolbar.
4. For **Data file**, click the open file icon  and select the file Postprocessing_demo.odb.
5. For **X-Type**, select **Step-4** and **Frequency**.
6. For **Y-Type**, select **V3-Spatial velocity (Time History)**; for **Y-Request**, select **Node 999**; and for **Y-Component**, select **Value**.



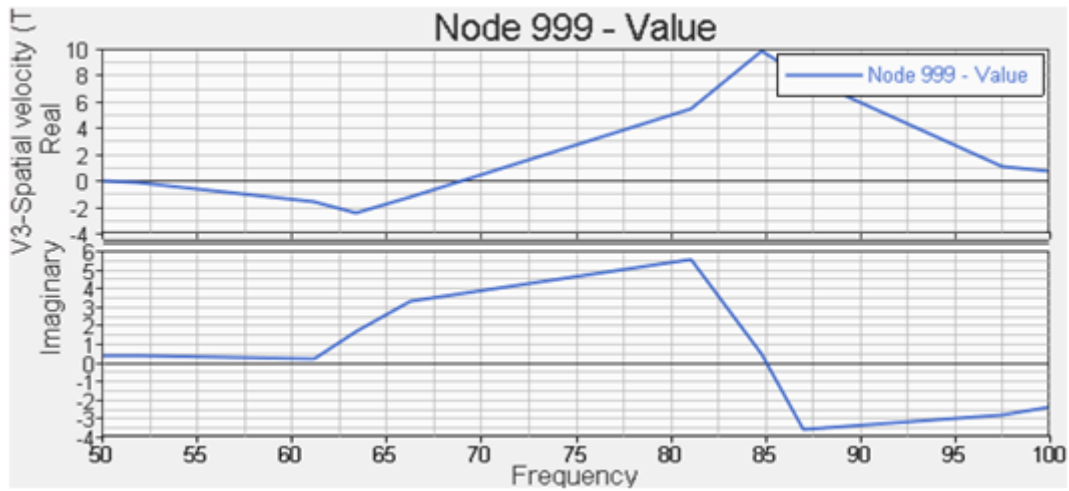
7. Click **Apply**.

This creates a complex plot with the Magnitude plotted on the bottom and the Phase plotted on the top.



8. Right click in the third window and select **Switch to Real/Imaginary**.

This updates the plot so that the Real component is plotted on the top and the Imaginary portion is plotted on the bottom.



Step 6: Save the session (optional).

1. Go to **File > Save as > Session**.
2. Enter in a name for the session file.
3. Click on **Save** to save this session file.

This file can be opened later to retrieve the saved session.