Altair HyperView 2019 Tutorials
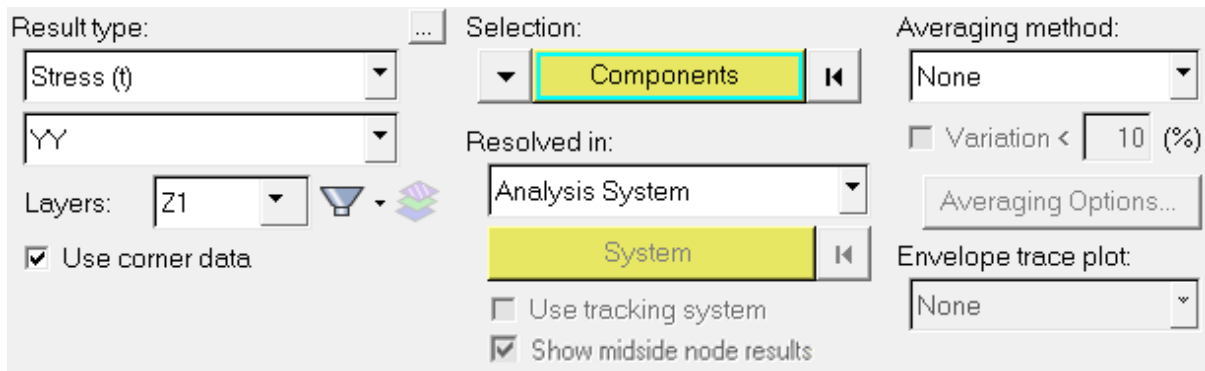
HV-3060: Transforming and Averaging Stresses

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In this tutorial, you will learn how to:

- Use various averaging methods for elemental stress

- Transform your results

Tools

- The **Averaging method** can be selected from the **Contour** panel.

Averaging of elemental results at a node refers to the average of all the element corner results passing through that node. If no corner results are available for an element, centroidal results will be used calculate the average. This option allows you to change the results from being element bound to being nodal bound. The various averaging options are **Simple**, **Advanced**, and **Difference**.

Exercise: Transforming and Averaging Stresses

This exercise uses the `bd03bkt.op2` file as both the model and the results file.

Step 1: Contouring the model results.

1. Load the `bd03bkt.op2` file, located in the `animation` folder.

2. Click the *Mask* panel button on the **Display** toolbar to enter the **Mask** panel.

3. Verify that the **Entities** input collector is set to *Elements*.

4. Click on *Elements*, and then select *By ID*.

5. Enter the following element IDs into the text box: `108, 16, 12, 107`.
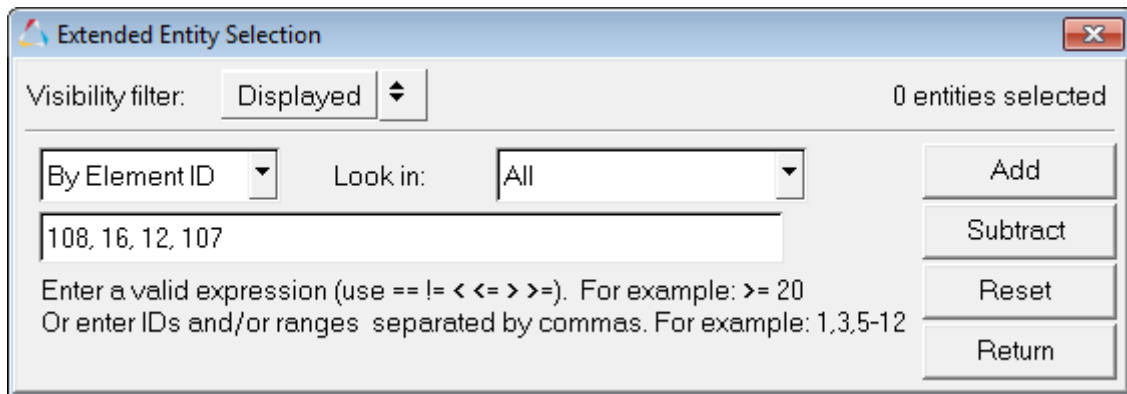
6. Click **Add**

7. Click **Return**.

8. Click **Mask Selected**.

9. Click on the **Reverse** button.

10. Click in the graphics area and press **'F'** on the keyboard, to fit the model to the active window.

11. Select the **Contour** panel from the toolbar .

12. For **Result type**, select **Stress (t)** and **vonMises**.

13. Set **Layers** to **Z1**.

14. Activate the **Use corner data** option.

   Activating this option allows you to view the results at the corners of the elements obtained from the integration/gaussian points.

15. Verify that the **Averaging Method** option is set to **None**.

16. Verify that **Resolved in** is set to **Analysis System**.

17. Click **Apply**.
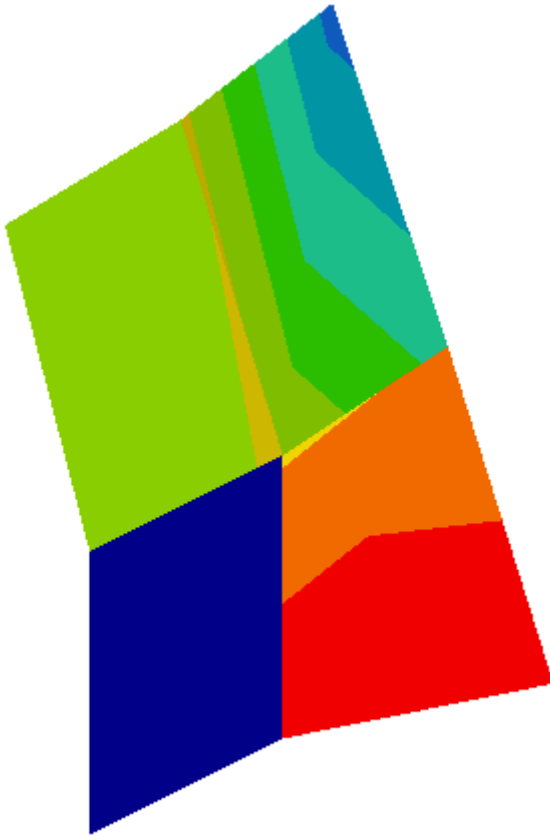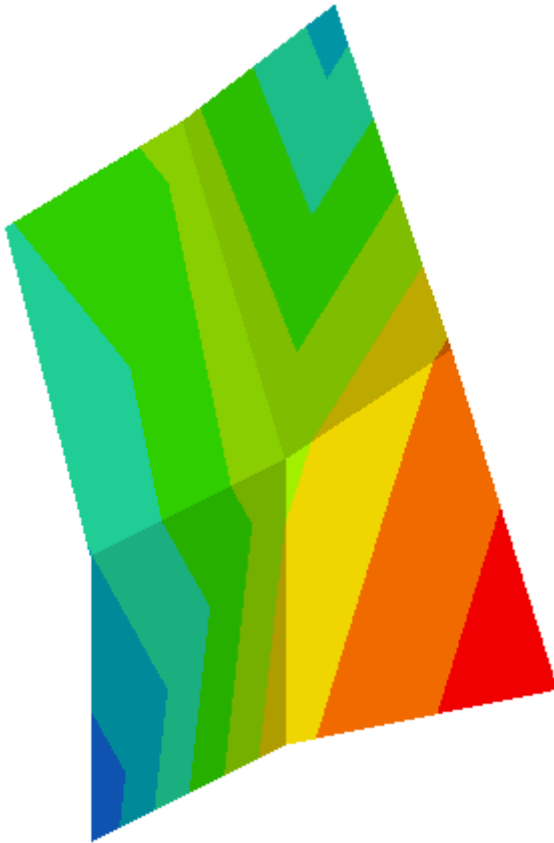

Observe the discontinuities in the contour around the node that is shared by all four elements.

Step 2: Averaging the elemental stresses using various averaging methods.

1. Change the **Averaging Method** to **Simple**.

2. Click **Apply**.

Note that the discontinuities around the node no longer exist, and you now are able to view the contour as bands.
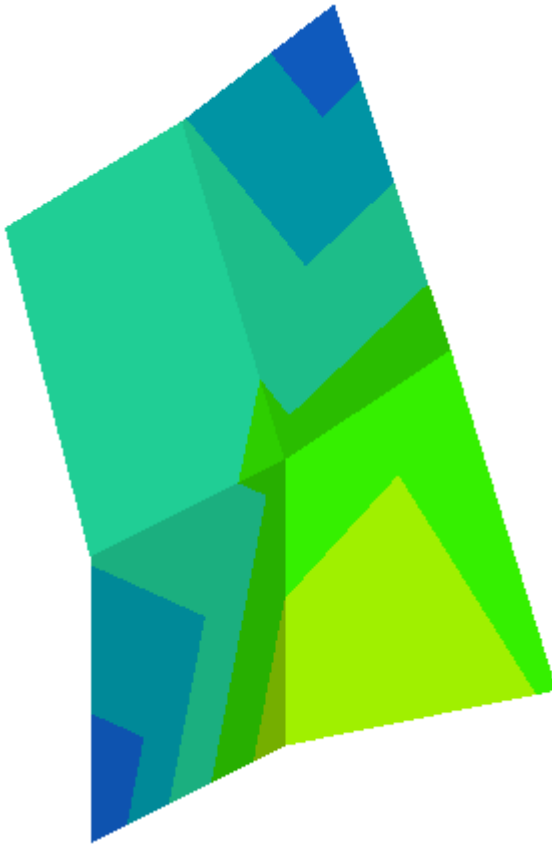
Simple averaging means that tensor and vector components are extracted and the invariants are computed prior to averaging. In this example, the vonMises is computed at the corner of each element for the layer Z1 and then is averaged to the nodes.

For additional information - see the *Simple averaging* topic (located in the *HyperView User's Guide*).

3. Change the **Averaging Method** to **Advanced**.

4. Verify that **Resolved In** is set to **Global System (proj: none)**.

5. Click on the **Projection Rule** button, and turn on **Projection (use projected axis as Sxx)**.

6.   Click *OK*.

The **Resolved in** system automatically changes to **Global System (proj: x, y)**.

Advanced averaging means that tensor (or vector) results are transformed into a consistent system, and then each component is averaged separately to obtain an average tensor (or vector). In this example, the stress components xx, yy, zz, xy, yz, xz are computed at the corners and then averaged to the nodes. From this averaged value, the invariants (like vonMises) are computed. These results are more accurate with advanced averaging.
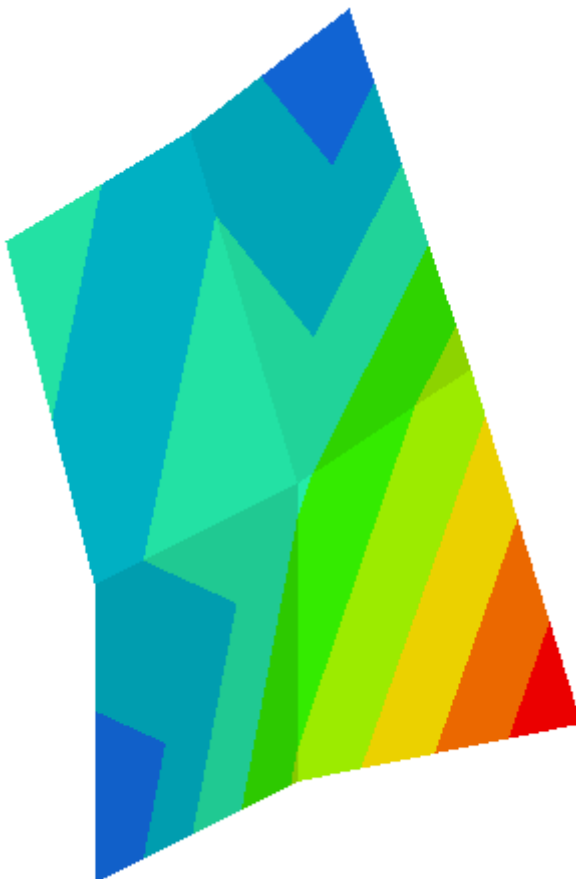
For additional information - see the *Advanced averaging* and *Projection Rule* topics (located in the *HyperView User's Guide*).

8.   Click the *Averaging Options* button to open the **Averaging Options** dialog.

9. Activate the ***Feature angle averaging*** check box and leave the **Feature angle** set to 50.
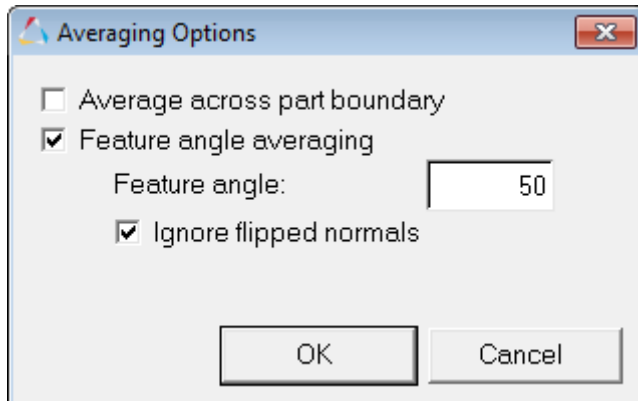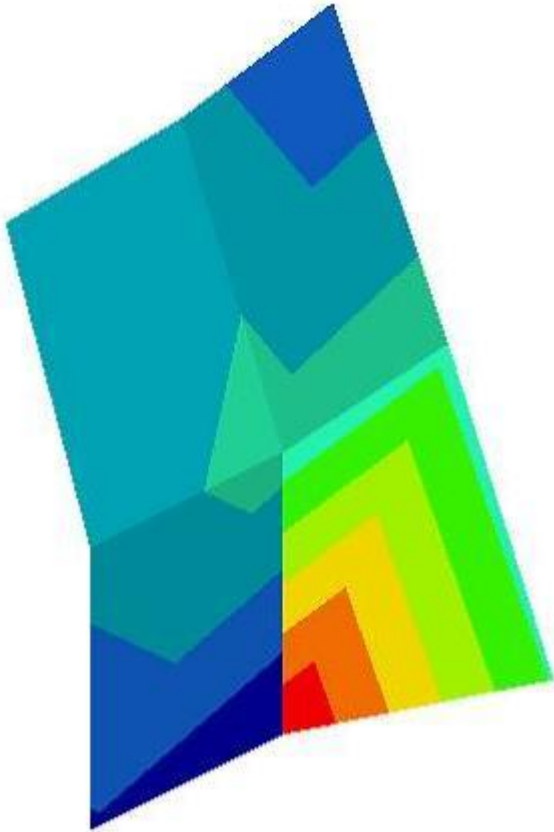

10. Click ***OK*** to close the window.

11. Click ***Apply*** to contour the model.

12. Click the ***Averaging Options*** button again to open the **Averaging Options** dialog.

13. Uncheck the **Feature angle averaging** option and the click ***OK***.

14. Activate the ***Variation*** option and enter `80` into the percentage box.

15. Click *Apply*.

The variation is the relative difference at a node, with respect to all nodes in the selected components.

The formula is described as follows:

Variation percentage at a node = (Difference at that node/Difference in all nodes from the selected components) x 100.
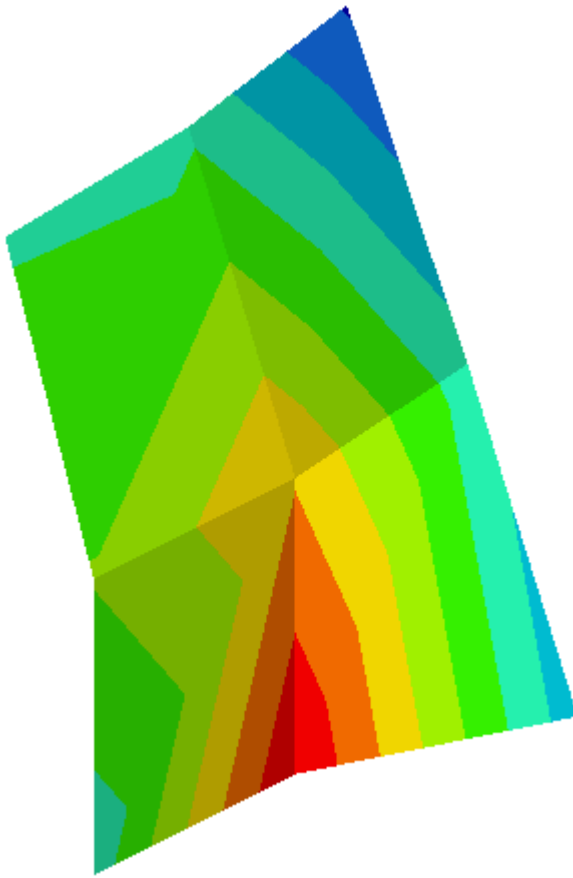
For additional information - see the *Variation Percentage Control* topic (located in the *HyperView User's Guide*).

16. Change the **Averaging method** to *Difference*.

17. Click ***Apply***.

This option displays the difference between the maximum and minimum corner results at a node. For tensor/vector components, the corresponding components from each element corner are extracted and the difference is calculated. For invariants, the corresponding invariants are computed from each element corner and then the difference is calculated.

For additional information - see the *Difference* topic (located in the *HyperView User's Guide*).