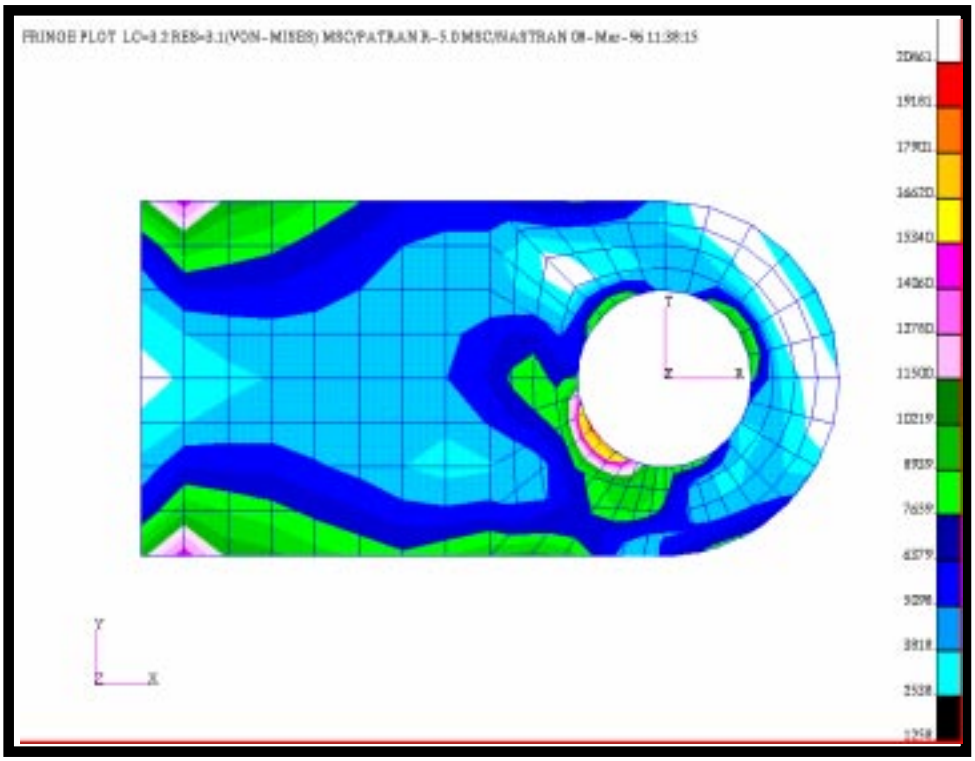
LESSON 17

Post Processing of Stress Results With Results



Objectives:

- To post-process stress results from MSC/NASTRAN.
- To use MSC/PATRAN to create fill and fringe plots to determine if the analyzed part will meet a customer-defined criteria or whether the part needs to be re-designed and re-analyzed.

Model Description:

In this exercise, you will examine the stress results of the clevis model analyzed using the MSC/NASTRAN code by rendering a variety of fringe and element fill plots.

Suggested Exercise Steps:

- Open the **clevis.db** database created in the previous exercise and turn off the deformed shape.
- Create a fringe plot of the **Von-Mises** stress in the clevis.
- Create and assign a new numerical range to the viewport. Use the name, **my_range**, and the values **Start= 22000** and **End=1000** to define the new range containing **15** subrange levels.
- Change the results label format to an exponential format.
- Render an element fill plot of the Von-Mises stresses.
- Create a Fringe plot of the Maximum Principal Stress for elements 1 through 20 only.
- Convert the stress tensor results to the scalar σ_{xx}, and create a fringe plot of the results with respect to the cylindrical coordinate system you created when building the clevis model. Plot the results on all elements.
- Create a new viewport and name it, **view**. Create a new group containing only finite element entities and name it, **fem1**. Post the group fem1 in the viewport view. In the default_viewport create a fringe plot of the **Von-Mises** stresses. In the fem1 viewport create a new range (**-20000** to **20000**) and then create a fringe plot of the **1st Invariant**.

Exercise Procedure:

1. Open the **clevis.db** database created in the previous exercise and turn off the deformed shape.

File/Open Database...

Existing Database Name **clevis.db**

OK

Select the reset Icon  from the System icons menu.

Create a Von-Mises Stress Scalar Plot

2. Create a fringe plot of the **Von-Mises** stress in the clevis.

In this step, we will show you how to make Fringe Plots of Von Mises stresses using the **Quick Plot** and the Fringe forms.

Needless to say, for this simple Fringe Plot, the *Quick Plot* form requires minimal input as compared to the **Fringe forms**. But, should the user desire to get more specialized results, the Fringe form will prove to be very useful.

Now, let us proceed using the *Quick Plot* form type.

◆ **Results**

Action:	**Create**
Object:	**Quick Plot**
Select Result Cases:	**Load_Case.1.SC1**
Select Fringe Result:	**Stress, Tensor**
Quantity:	**Von Mises**

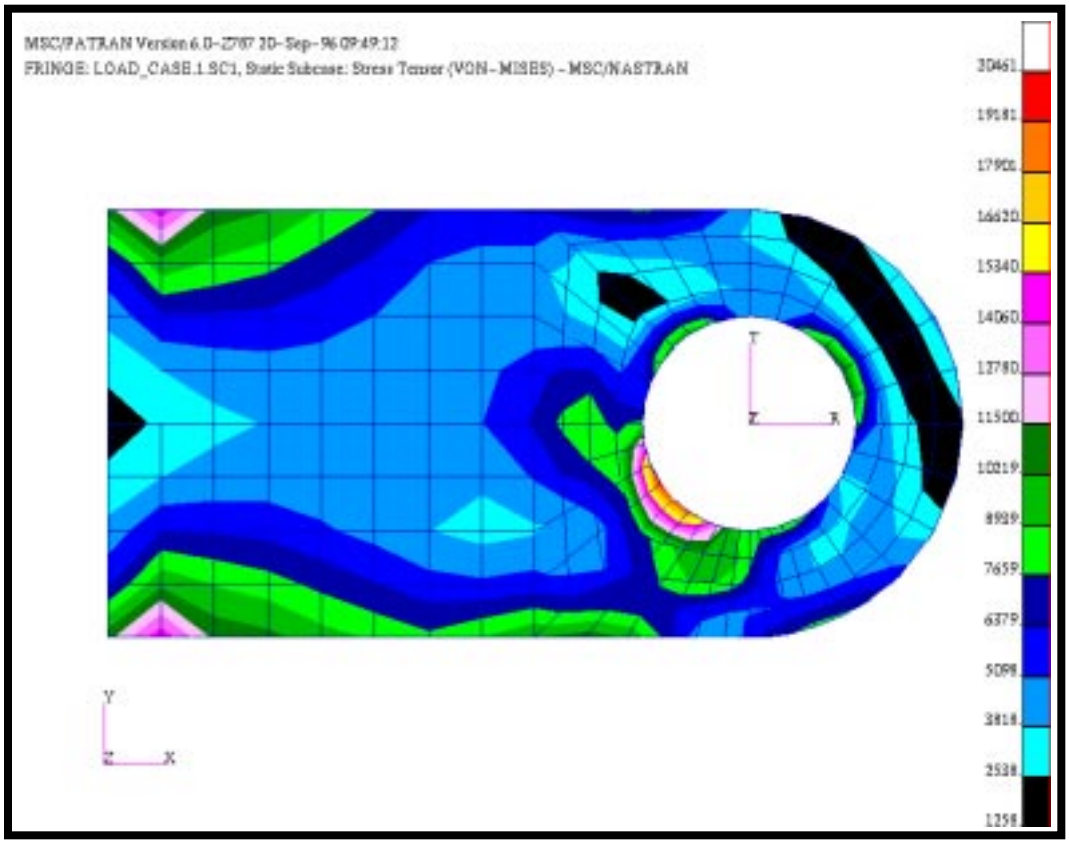
Apply

Turn on the Edge Display

Display/Shading

Show Edges

Apply



Now, let's see if the results are different using the Fringe form to plot the Von Mises stress.

Object:	**Fringe**
Select Result Case(s):	**Load_Case.1.SC1**
Select Fringe Result:	**Stress Tensor**
Quantity:	**Von Mises**

Apply

The two plots are identical, as they should be; you are plotting the same results.

Create and Apply a New Results Range

3. Create and assign a new numerical range to the viewport. Use the name, **my_range**, and the values **Start= 22000** and **End=1000** to define the new range containing **15** subrange levels.

By default, MSC/PATRAN assigns Result ranges based on the Min/Max values of the result dependent variable currently selected. In this step you will create a new range, which varies from 1000 to 22000, and apply this range to the fringe plot posted in the current viewport.

◆ **Results**

Action: **Create**

Object: **Fringe**

Click on the Display Attributes button.

Range...

Define Range

Create...

New Range Name: **my_range**

OK

Then in the Ranges form, make sure the Data Method is set to Semi-Auto and set the starting point as 22000 and the end as 1000.

Data Method: ◆ **Semi-Auto**

Start: **22000**

End: **1000**

Calculate

Apply

Assign Target Range to Viewport

Cancel

Choose my_range, Post Range to Viewport and click on OK in the **Set Range** form.

Set Range: **my_range**

Post Range to Viewport

OK

In the **Results** form.

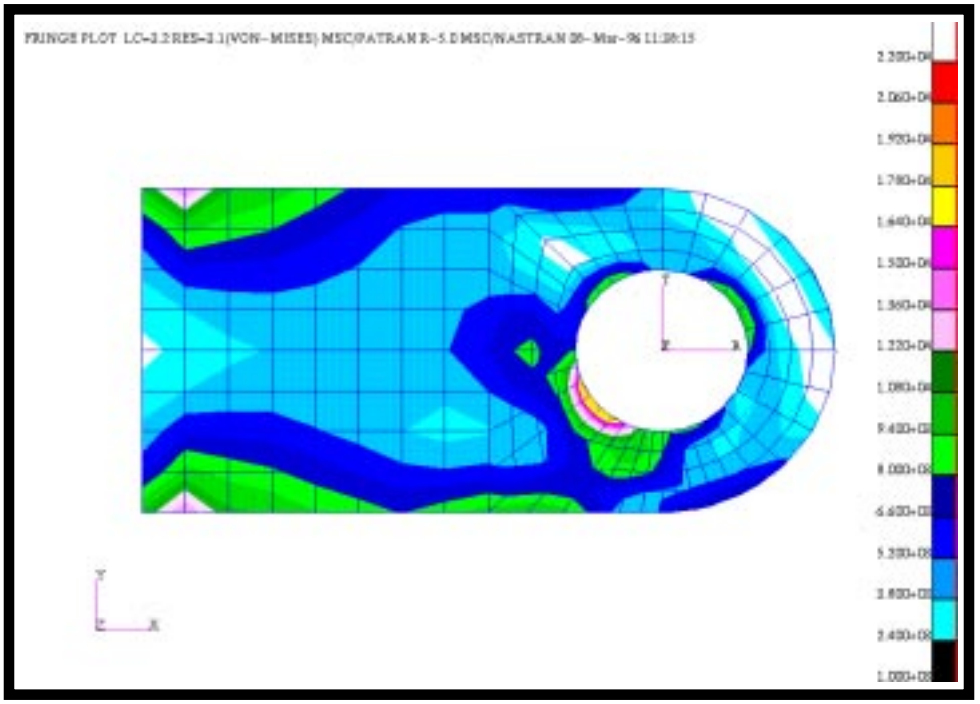
Label Style...

Label Format: **Exponential**

OK

Apply

Your fringe plot should look like the one shown in the figure below.



4. Render an element fill plot of the Von-Mises stresses.

Create an Element Fill Plot

Fringe plots are based on averaging the stress results of the elements connected to a particular node. The averaging operation tends to low-pass filter the results, dampening out large variations of stresses across the elements. Ideally, as the element mesh density becomes finer, the stress jump across the elements will decrease and the averaging operation will not be so critical. Nevertheless, in general for coarse meshes one will obtain better accuracy with element fill plots.

In MSC/PATRAN, one can individually color-code the elements with respect to a result attribute known at the center of the element. It has been shown in the finite element literature that the stresses at the center

of the element are most accurate provided a 2X2 Gauss integration is used for the numerical integration. In this step, you will create an "Element Fill" plot based on a Von-Mises scalar results.

Action:	**Create**
Object:	**Fringe**

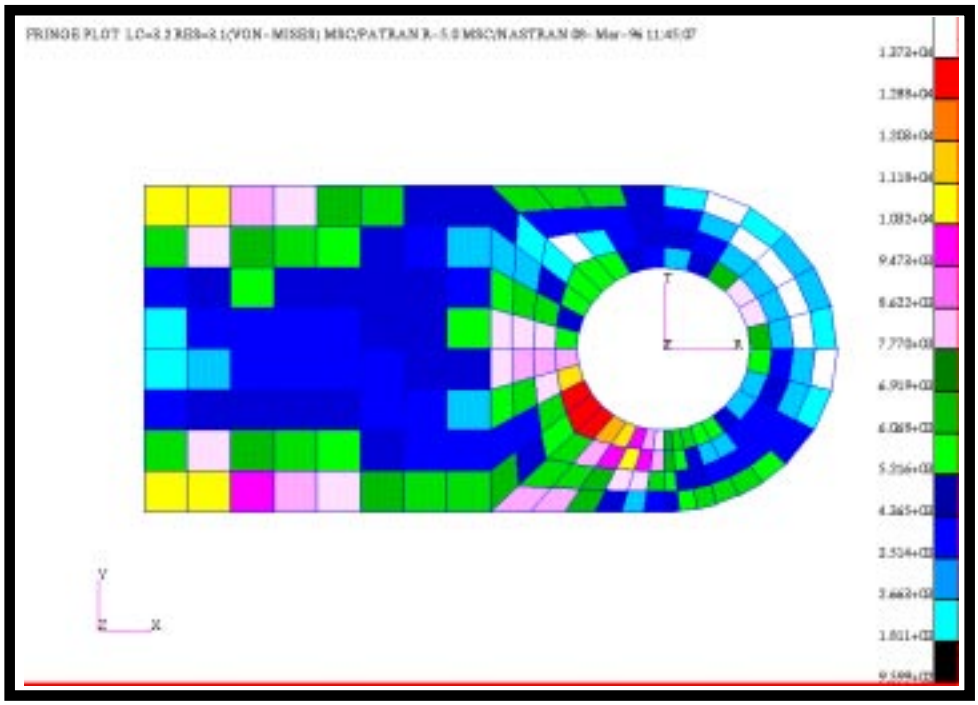
Now click on the Plot Options icon.

Averaging Definition:

Domain:	**None**
Extrapolation:	**Average**

Apply

Your Viewport should appear as follows.



Filter Display

5. Create a fringe plot of the maximum principle stress for elements 1 through 20 only.

Post Processing of Stress Results

MSC/PATRAN allows the user to filter the displayed results based on element ID's, results range, property type, etc. In this step, you will plot the maximum principal stress for elements 1:20.

Action:	**Create**
Object:	**Fringe**

Click the Select Results Button

Select Result Case(s):	**Load_Case.1.SC1**
Select Fringe Result:	**Stress Tensor,**
Quantity:	**Max Principal**

Click on the Target Entities icon

Target Entity:

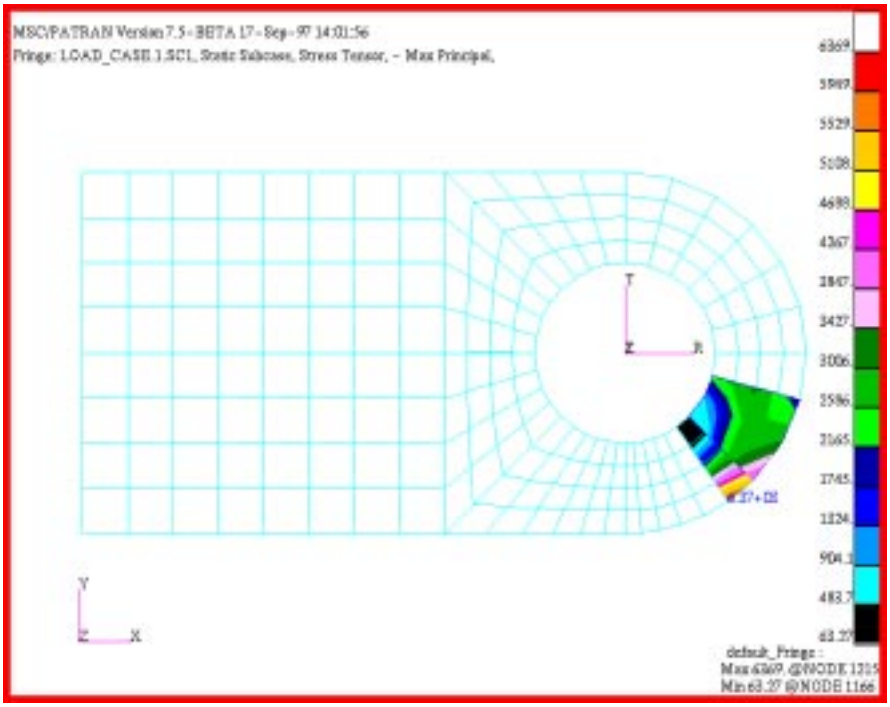
	Elements
Select Elements:	**Elm 1:20**

Click on the Plot Options Button

Averaging Definition:

Domain	**All Entities**

Apply



Transform Result Coordinate Frame

6. Convert the stress tensor results to the scalar σ_{xx}, and create a fringe plot of the scalar with respect to the cylindrical coordinate system you created when building the clevis model. Plot the results on all elements.

Action: **Create**

Object: **Fringe**

Click on the Select Results Button

Quantity: **X Component**

Click on the Target Entities button

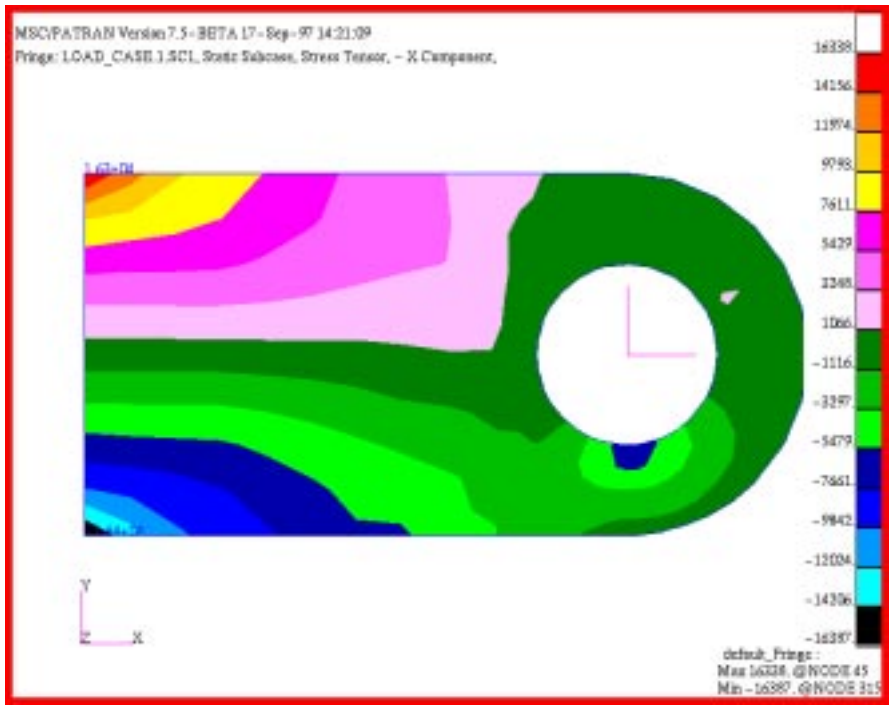
Target Entity: **Current Viewport**

Click on the Plot Options button

Coordinate Transformation:	**CID**
Select Coordinate Frame:	**Coord 1**

Apply

Remember to turn on the **Show Edge** in *Display/Shading...* form.



Create and Post Two Different Fringe Plots

7. Create a new viewport, and name it, **view**. Create a new group containing only finite element entities and name it, **fem1**. Post the group fem1 in the viewport view. In the default_viewport create a fringe plot of the **Von-Mises** stresses. In the fem1 viewport create a new range (**-20000** to **20000**) and then create a fringe plot of the **1st Invariant**.

In this final step you will create fringe plots of the Von-Mises and Principal stresses in the clevis model. You will post each result type in a different viewport. Both viewports will be posted to the display screen. They will contain identical copies of the finite element model but different groups and each viewport will be assigned a unique range.

The first thing to do is to create a Von Mises fringe plot in the existing viewport.

Click on the Select Results Button

Quantity: **Von Mises**

Apply

Now, create a new viewport called **view**.

Viewport/Create...

New Viewport Name: **view**

Apply

Cancel

Now, create a new group call **fem1**, containing only FEM.

Group/Create...

New Group Name: **fem1**

Make Current

Unpost All Other Groups

Group Contents: **Add All FEM**

Apply

Cancel

Now, create a new range called **range1**, spanning from 20,000 to -20,000.

Display/Ranges...

Create...

New Range Name: **range1**

OK

Data Method: ◆ **Semi-Auto**

Start: **20000**

End: **-20000**

Calculate

Apply

Assign Target Range to Viewport

Cancel

Click on the Select Results Button

Finally, create a plot of the 1st invariant.

Quantity: ◆ **1st Invariant**

Apply

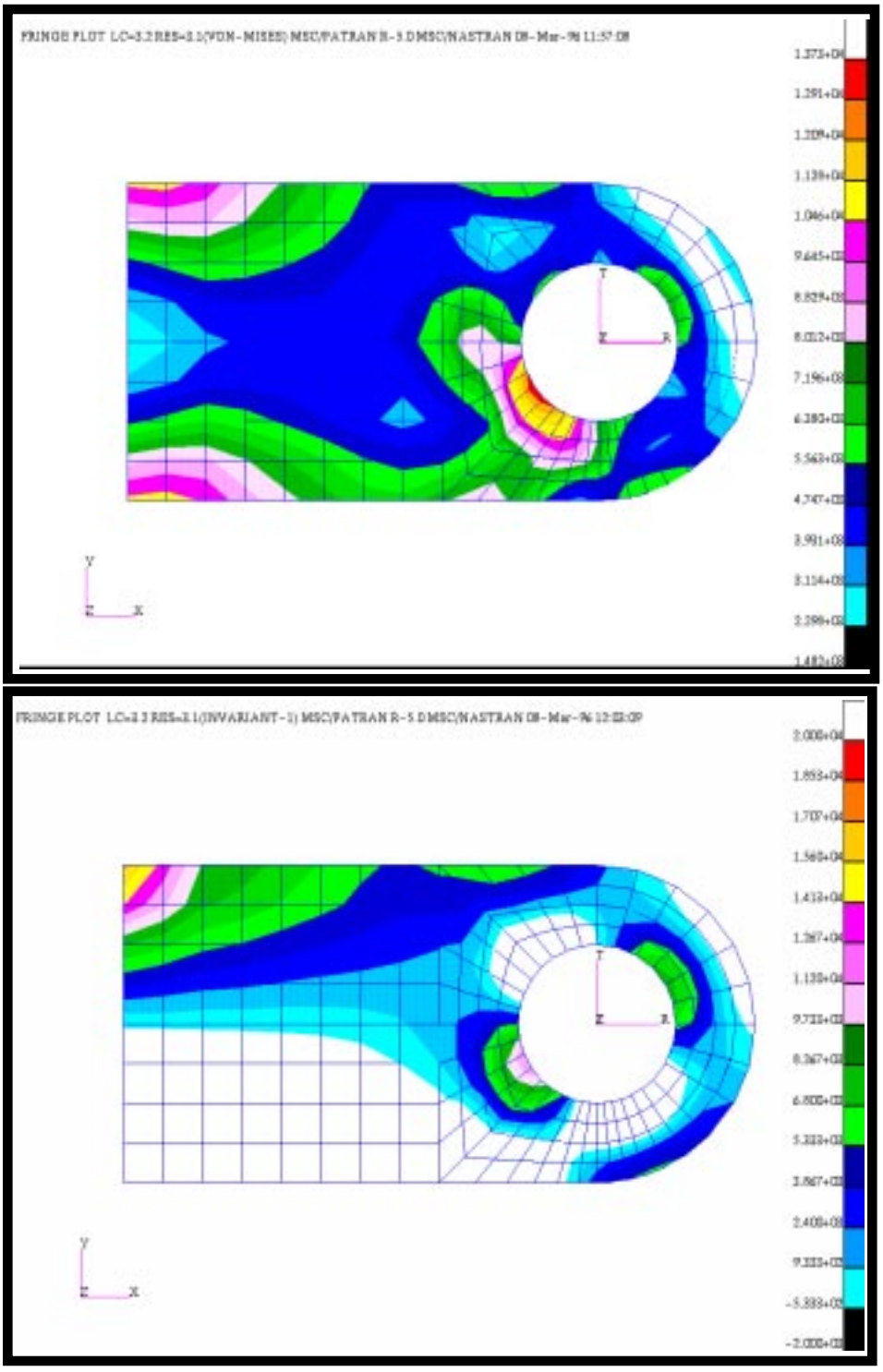
Click on the Display Attributes button.

Range...

Set Range: **range1**

OK

Your display screen should show the following viewports and fringe plots.



File/Quit