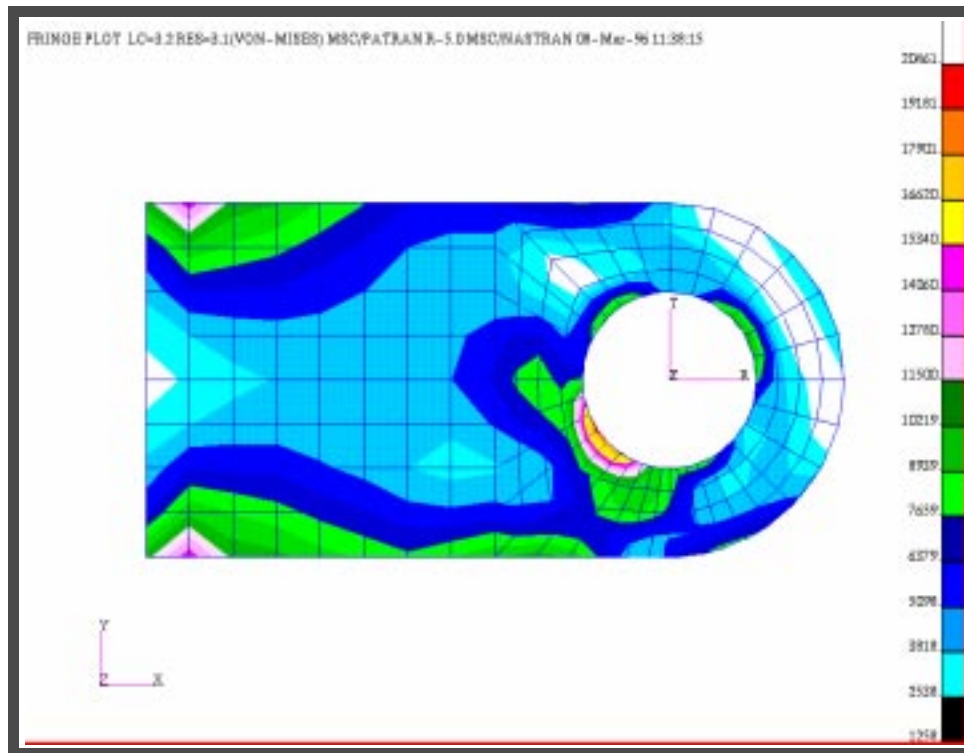


WORKSHOP 16

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 selected elements.
- 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...

Existing Database Name

clevis.db

OK

Select the **Reset Graphics** Icon.



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**

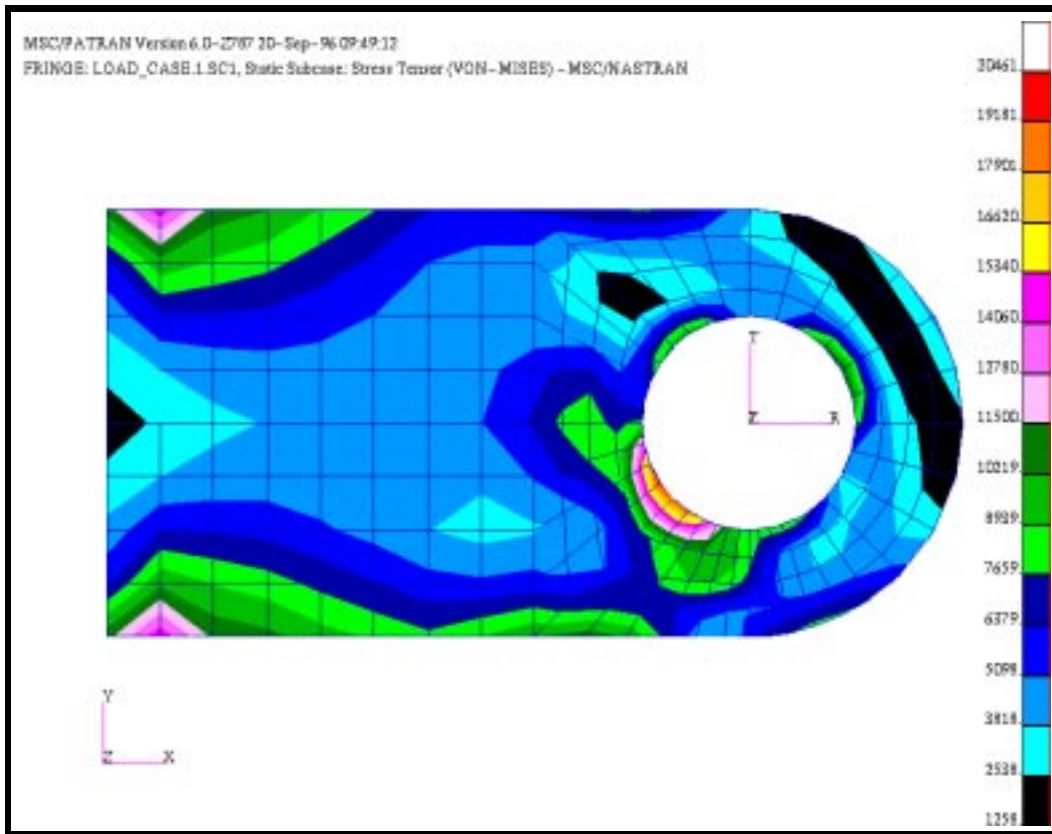
<i>Action:</i>	<input type="text" value="Create"/>
<i>Object:</i>	<input type="text" value="Quick Plot"/>
<i>Select Result Cases:</i>	<input type="text" value="Load_Case.1.SC1"/>
<i>Select Fringe Result:</i>	<input type="text" value="Stress, Tensor"/>
<i>Quantity:</i>	<input type="text" value="Von Mises"/>

Next, turn on the display of Finite Element Edges located under the Fringe Attributes button.



<i>Display:</i>	<input type="text" value="Element Edges"/>
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**Create a
Von-Mises
Stress
Scalar Plot**



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

<i>Object:</i>	Fringe
<i>Select Result Case(s):</i>	Load_Case.1.SC1
<i>Select Fringe Result:</i>	Stress Tensor
<i>Quantity:</i>	Von Mises
Apply	

The two plots are identical, as they should be; you are plotting the same results, dont forget to turn on display of element edges.

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.

Create and Apply a New Results Range

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:

Object:

Click on the Display Attributes button.



New Range Name

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

End

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

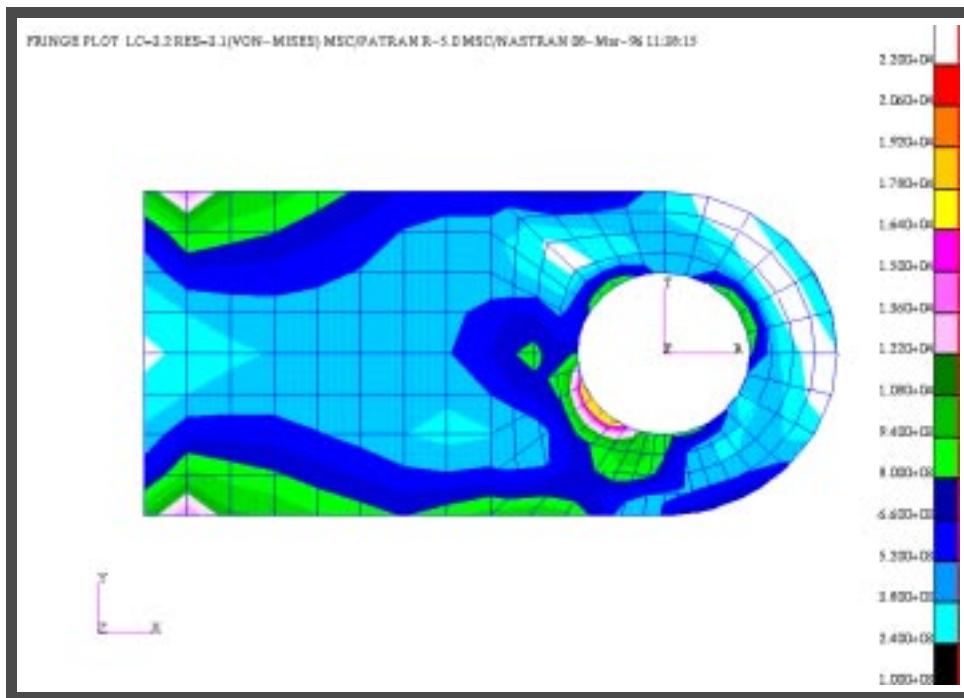
Set Range

Post Range to Viewport

In the Display Attributes under **Results** form make sure following are selected.

<i>Display:</i>	Element Edges
Label Style...	
<i>Label Format</i>	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.

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.

**Create an
Element Fill
Plot**

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:

Object:

Now click on the Plot Options icon.

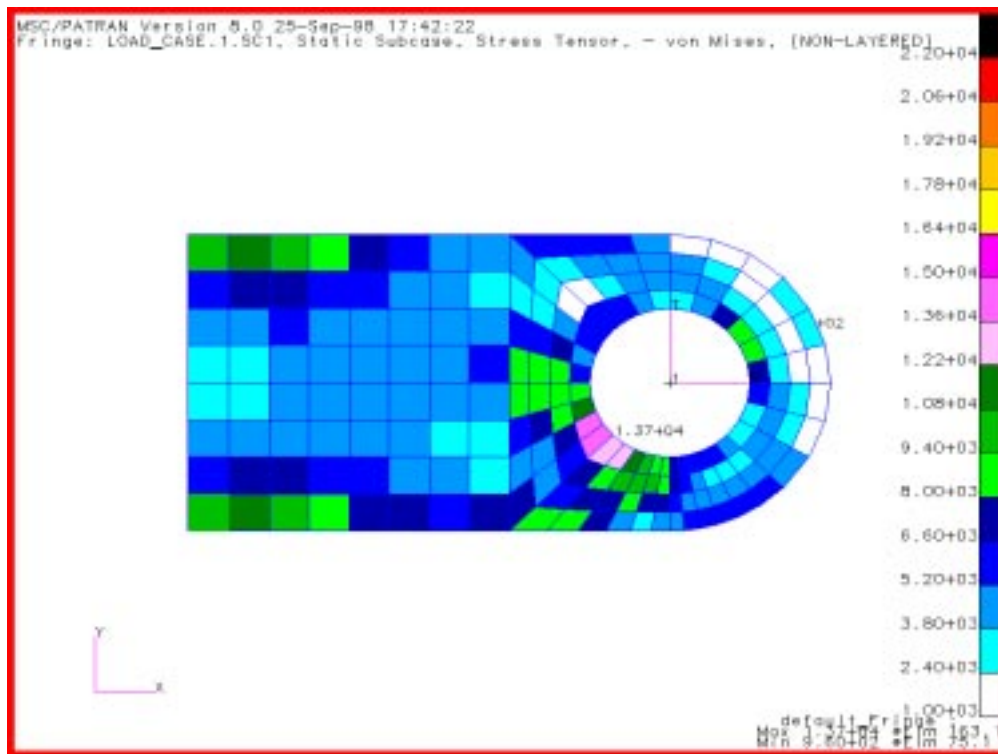


Averaging Definition:

Domain:

Extrapolation:

Your Viewport should appear as follows.



5. Create a fringe plot of the maximum principle stress for selected elements.

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 selected elements.

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 45:48 61:64 77:80

Click on the Plot Options Button



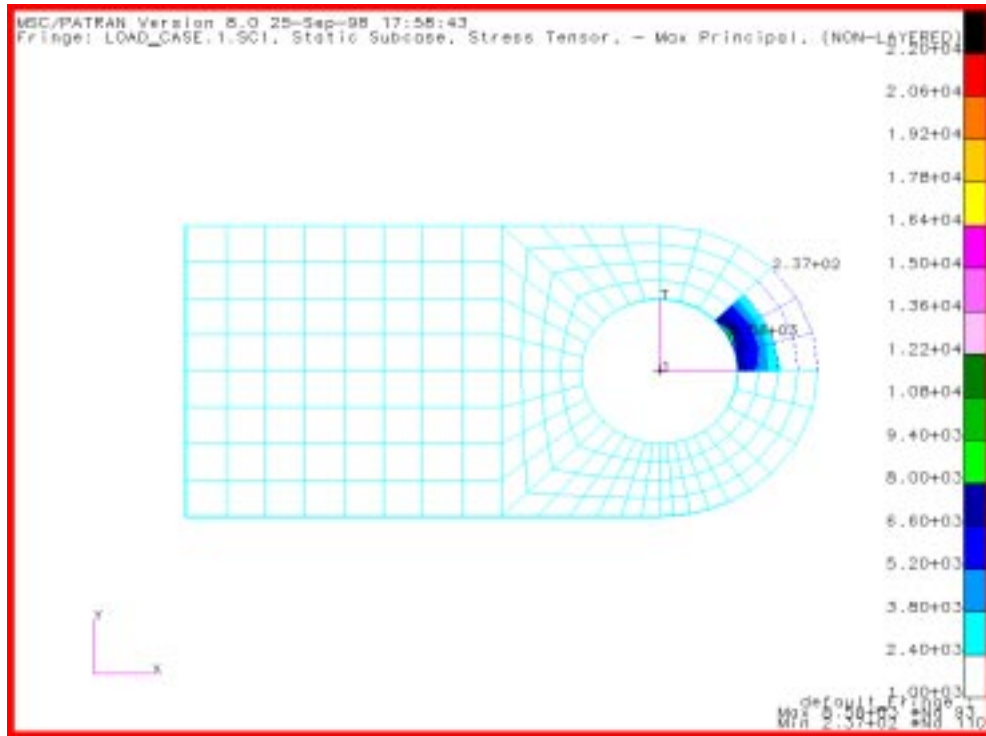
Averaging Definition:

Domain

All Entities

Apply

The following plot shown, is displayed with the Fringe default spectrum. To obtain exact match, plot with FRI_default_Fringe range.



**Transform
Result
Coordinate
Frame**

- 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:

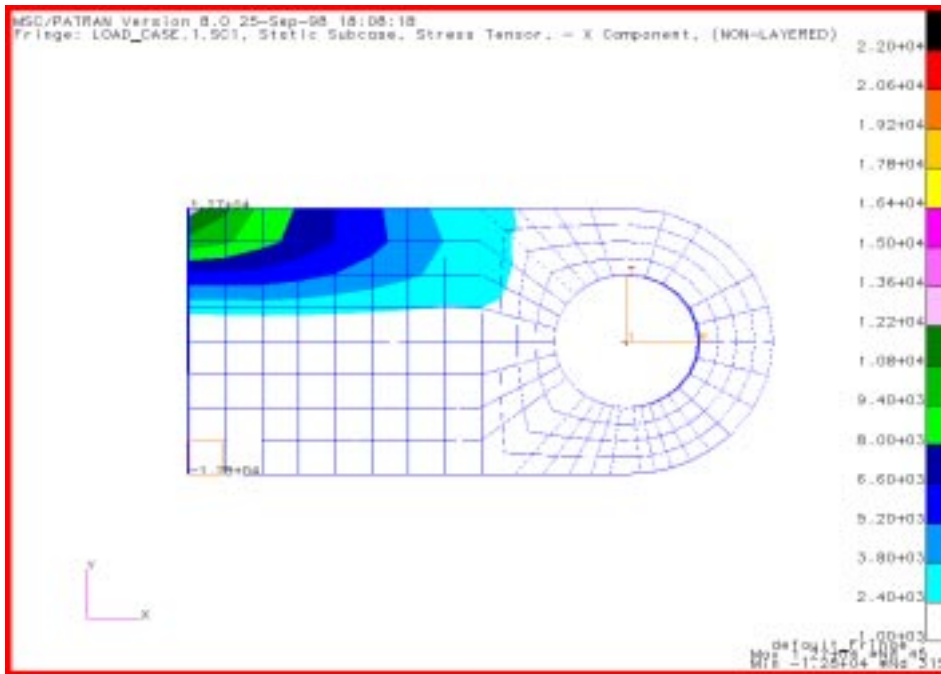
CID

Select Coordinate Frame:

Coord 1

Apply

Remember to turn on the **Element Edges** display in *Display Attributes* form if necessary.



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



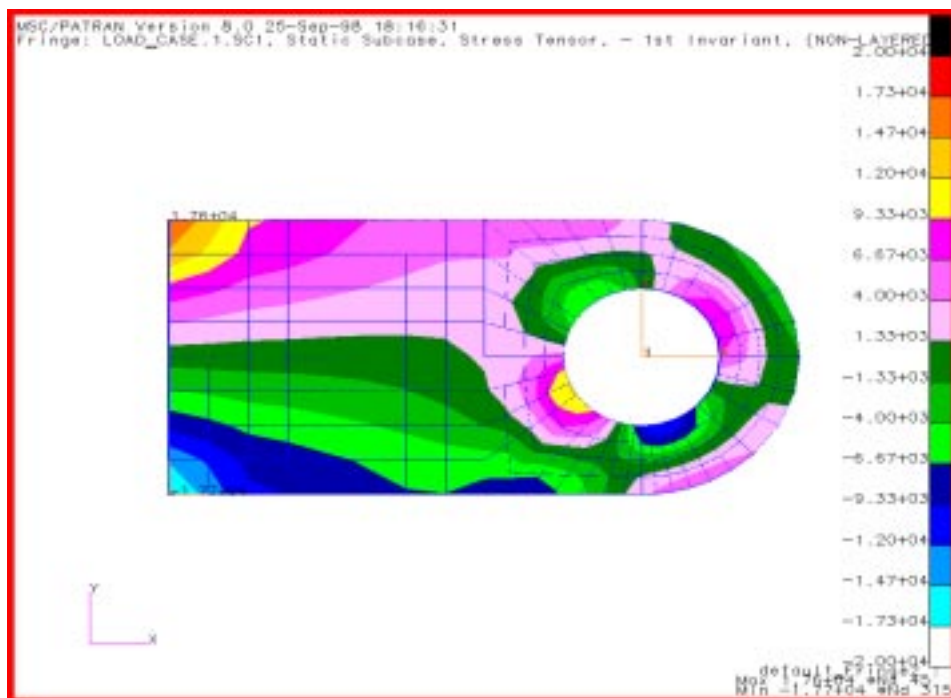
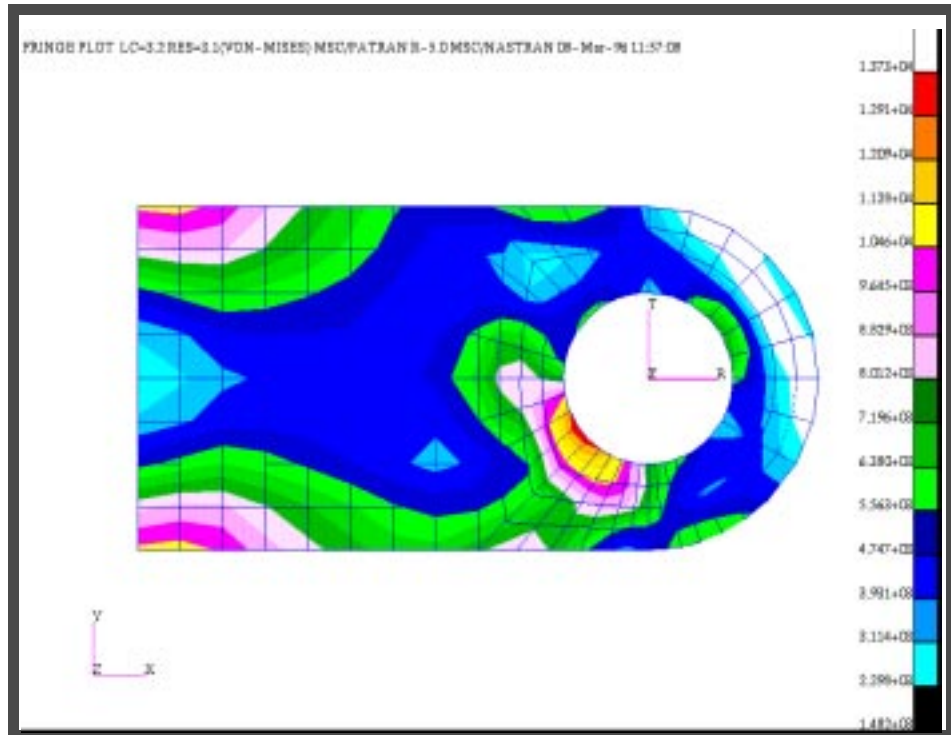
Finally, create a plot of the 1st invariant.

Quantity:◆ **1st Invariant****Apply**

Click on the Display Attributes button.

**Range...***Set Range***range1****OK****Apply**

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



File/Quit...