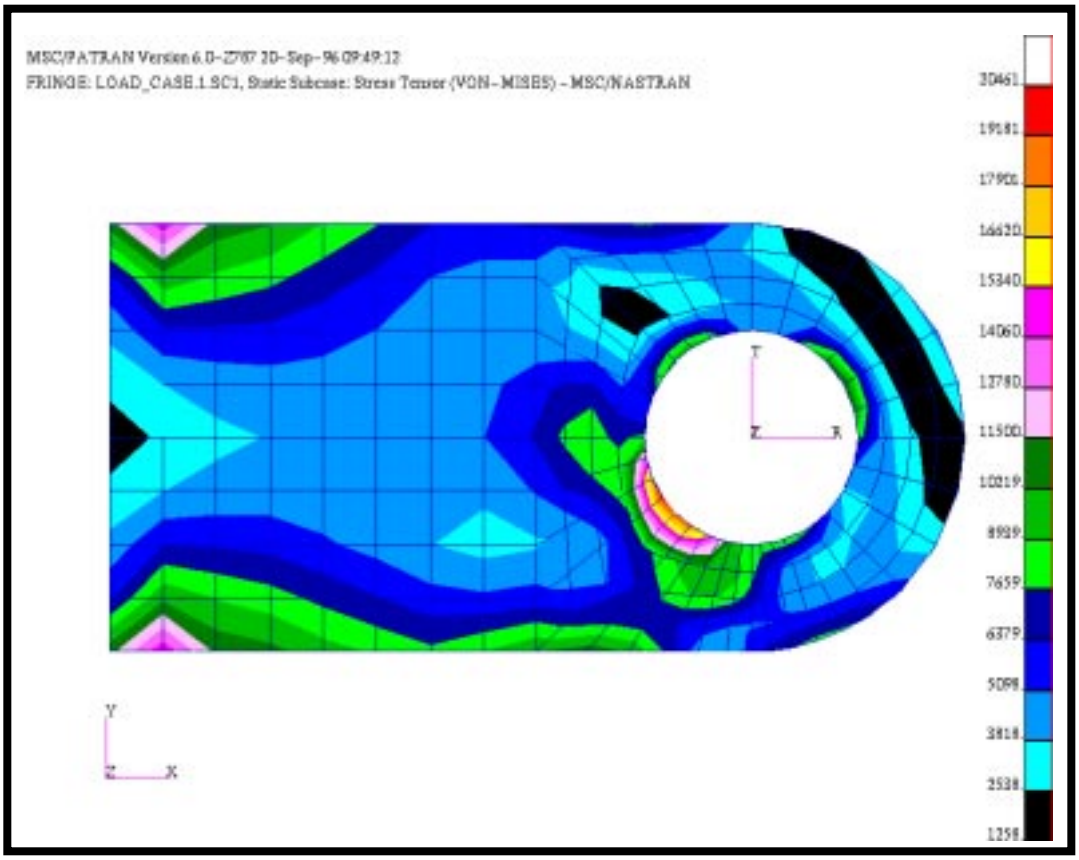
LESSON 7

Post Processing of Stress 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.

Exercise Procedure:

1. Create a new database and name it **clevis2**.

File/New...

New Database Name: **clevis2.db**

OK

The viewport (PATRAN's graphics window) will appear along with a *New Model Preference* form. The *New Model Preference* sets all the code specific forms and options inside MSC/PATRAN.

In the *New Model Preference* form set the *Tolerance* to **Default.**

Tolerance: ◆ **Default**

Analysis Code: **MSC/NASTRAN**

Analysis Type: **Structural**

OK

2. Import the new clevis model and results for this exercise by reading the output2 file **`clevis.op2`**.

◆ **Analysis**

Action: **Read Output2**

Object: **Both**

Method: **Translate**

Select Results File...

Selected Results File: **clevis.op2**

OK

Apply

3. 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**

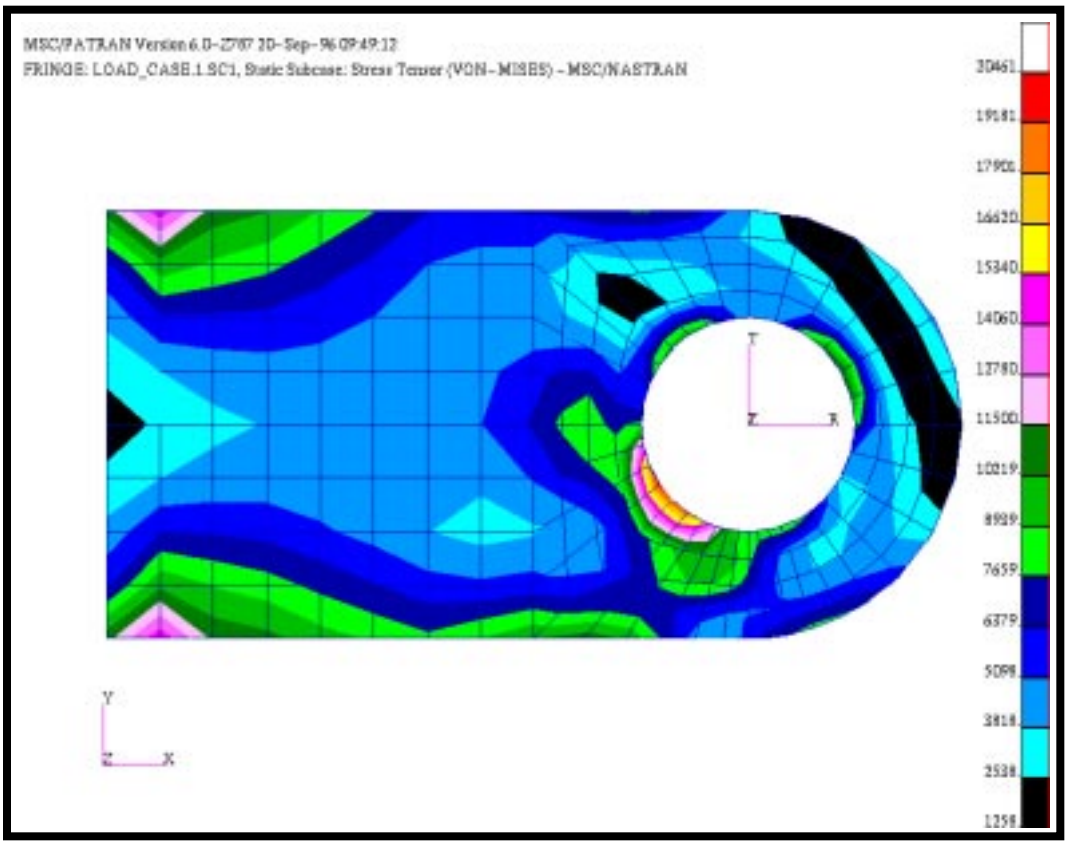
Apply

Display/Shading...

■ Show Edges

Apply

Cancel



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.

4. 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**

..

Display Attributes

Range...

Define Range

Create...

New Range Name: **my_ranges**

OK

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

Cancel

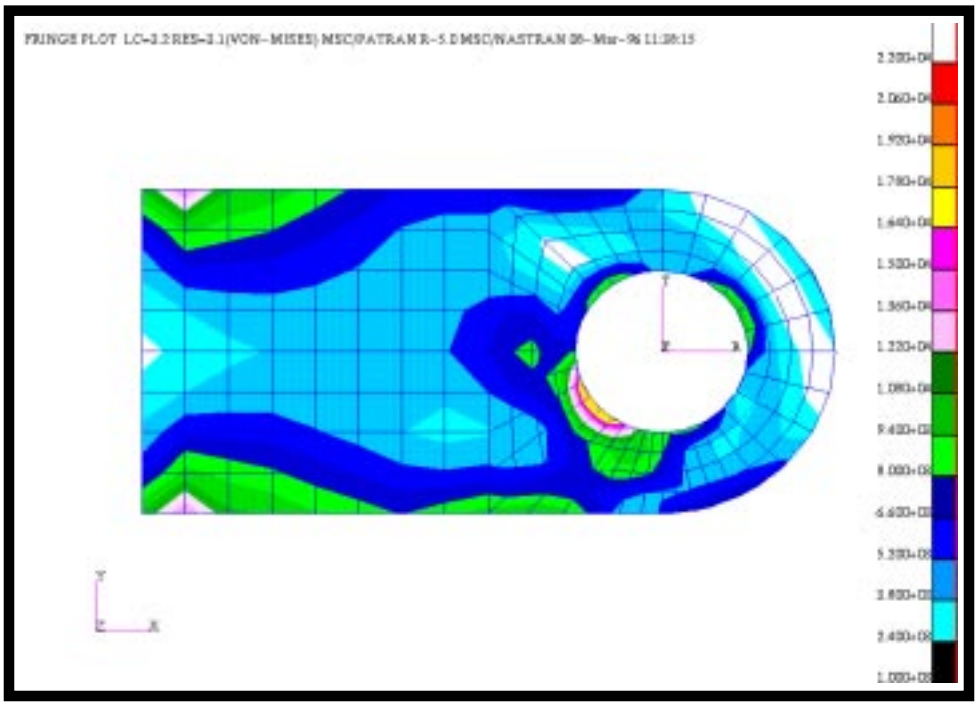
Label Style...

Label Format: **Exponential**

OK

Apply

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



5. 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.

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**

.

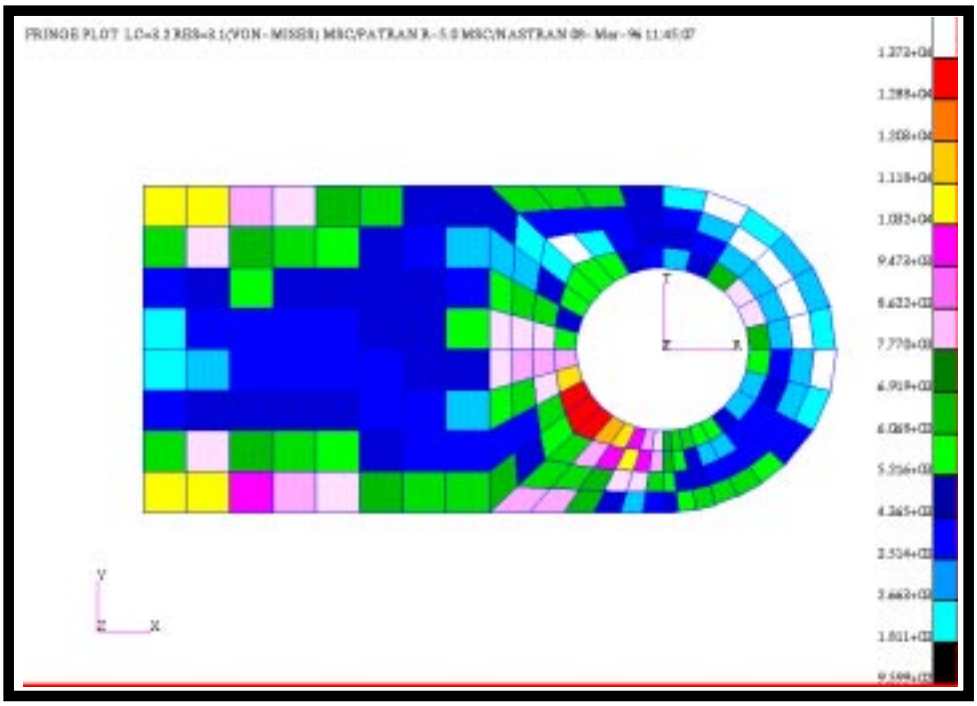
Plot Options

Domain: **None**

Extrapolation: **Average/Derive**

Apply

Your Viewport should appear as follows.



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

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**

Select Results

Select Result Case(s):	**Load_Case.1.sc1**
Select Fringe Result:	**Stress Tensor**
Quantity:	**Max Principal**

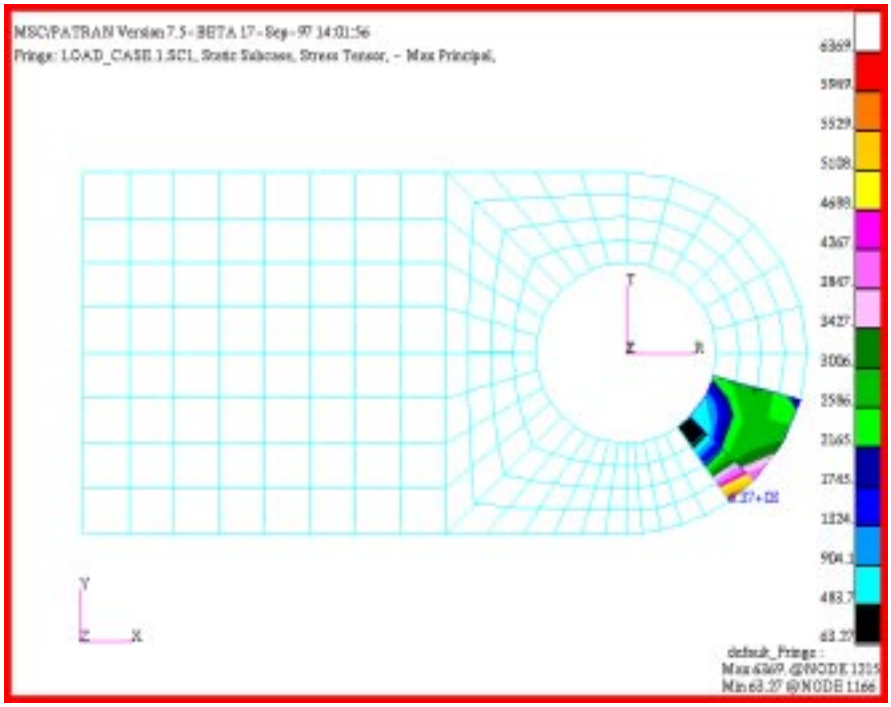
Target Entities

Target Entity:	**Elements**
Select Elements:	**Elm 1:20**

Plot Options

Domain	**All Entities**

Apply



7. 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**

Select Results

Quantity: **X-Component**

Target Entities

Target Entity: **Current Viewport**

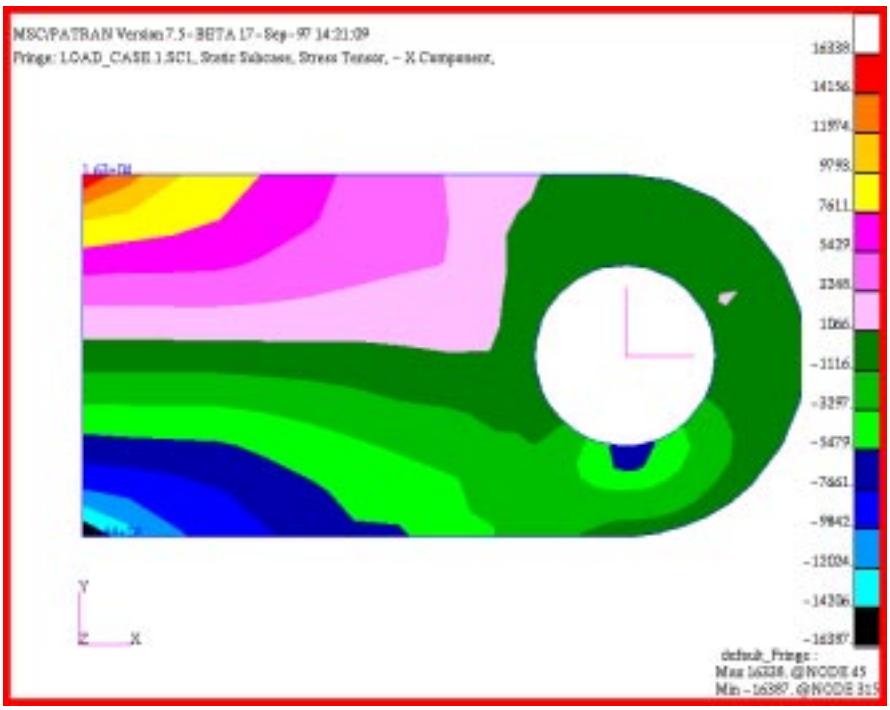
Plot Options

Coordinate Transformation: **CID**

Select Coordinate Frame: **Coord1**

Apply

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



8. 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.

Select Results

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

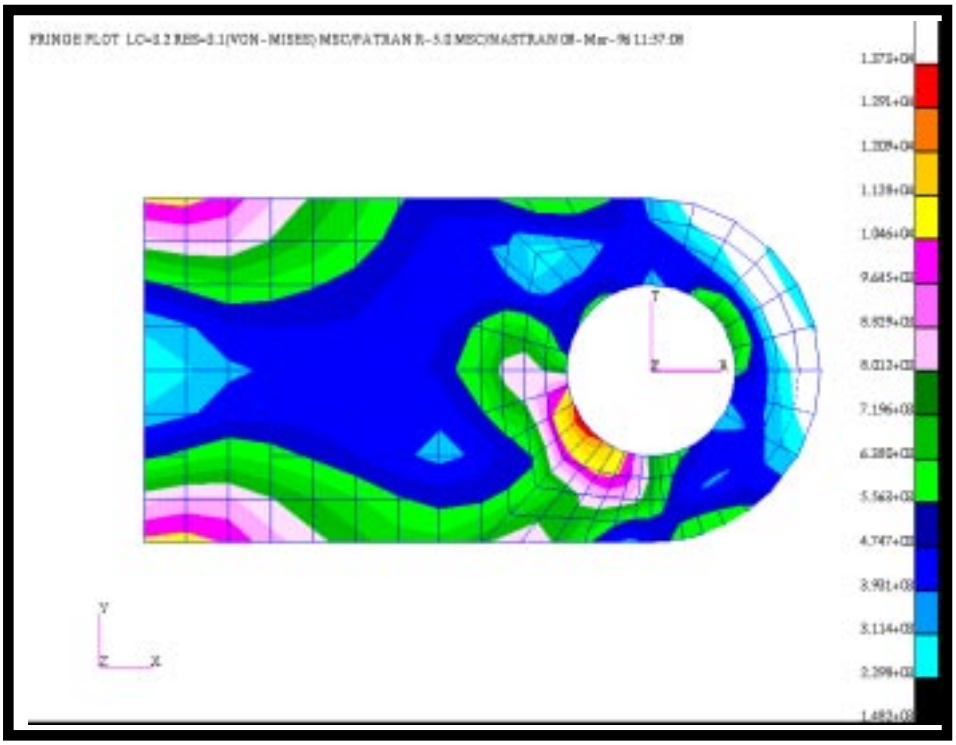
Select Results

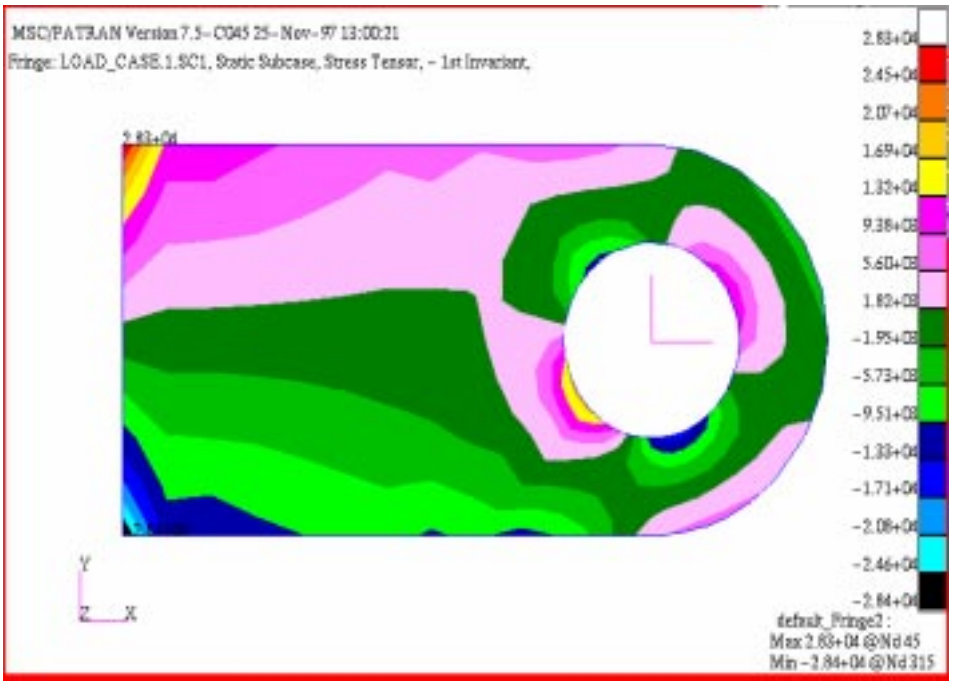
Finally, create a plot of the 1st invariant.

Quantity: ◆ **1st Invariant**

Apply

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





Quit MSC/PATRAN when you are finished with this exercise.