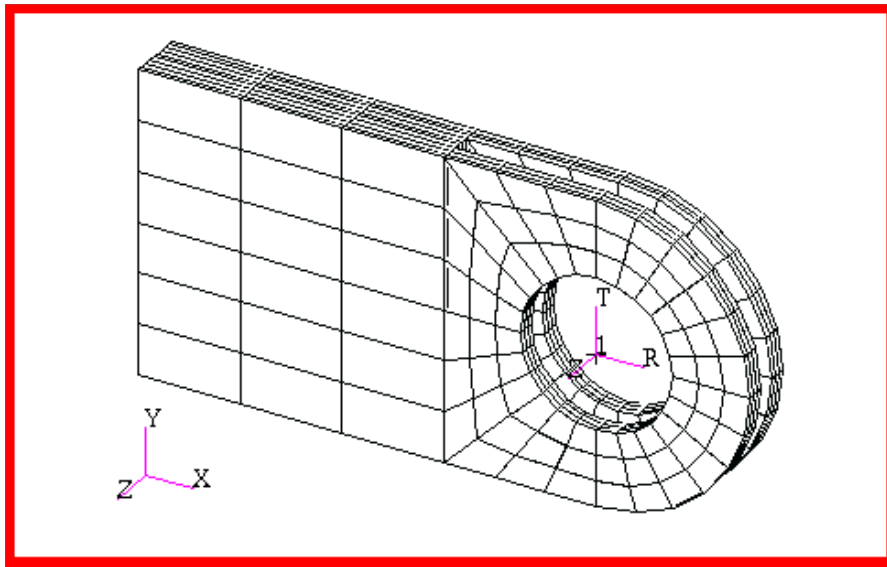# LESSON 4

Loads and Boundary Conditions on a 3-D Clevis

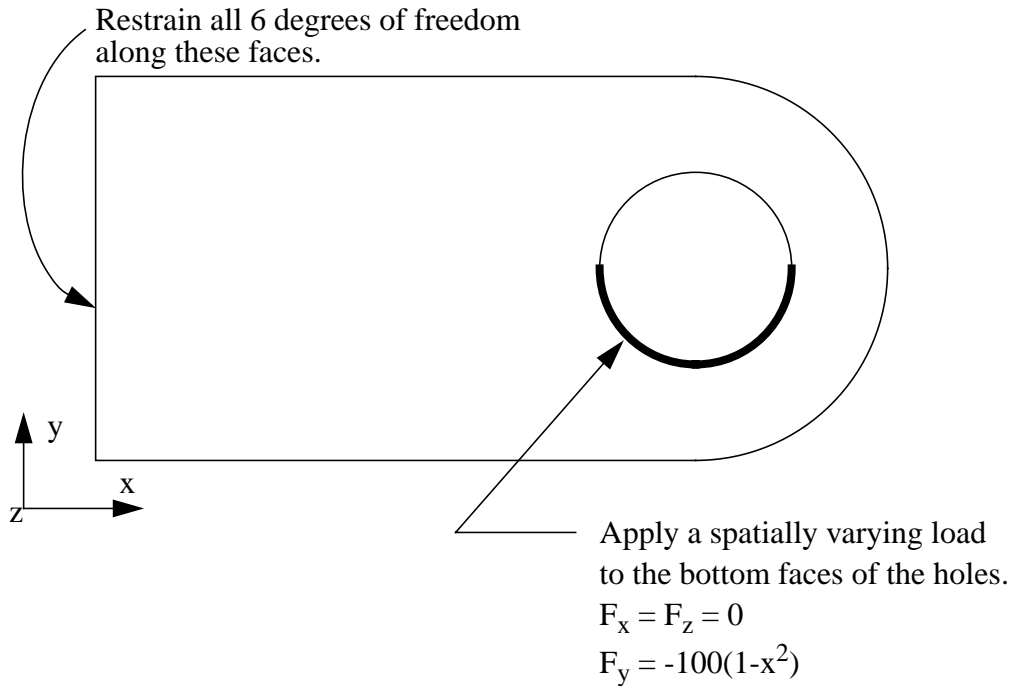## Objectives:

■ Apply constraints to your model.

■ Create and apply a **Field** to describe a spatially varying load.

Loads and B/C's on a 3-D Clevis

Model Description:

In this exercise you will create a loading condition and a constraint set for the clevis model. The base of the lug will be clamped. The hole will be loaded downward with a quadratically varying load $F_y = -100(1-x^2)$ generated from a vector field.

Restrain all 6 degrees of freedom along these faces.

y

x

z

Apply a spatially varying load
to the bottom faces of the holes.
$F_x = F_z = 0$
$F_y = -100(1-x^2)$

Figure 4-1

Suggested Exercise Steps:

■ Open the database, **Clevis.db**.

■ Create a spatially varying vector field named **Quadratic_load**, using the vector components described in the figure above.

■ Create a nodal displacement boundary condition named **Clamped**, which restrains all degrees of freedom. Apply it to the geometry faces shown in the figure above.

■ Create a force boundary condition named **Vertical_load**, which uses the **Quadratic_load** field. Apply it to the solid faces along the bottom half of the holes.

■ Display both the displacement and force on the finite element model.

Exercise Procedure:

1. Open the database, **Clevis.db**..

File/Open...

Existing Database Name: **Clevis.db**

| OK |

2. Create a spatially varying vector field named **Quadratic_load**, using the vector components described in Figure 4-1.

◆ **Fields**

Action:	**Create**
Object:	**Spacial**
Type:	**PCL Function**
Field Name:	**Quadratic_load**
Field Type:	**Vector**
Second Component:	**-100*(1-'X**2)**

| Apply |

3. Create a nodal displacement boundary condition named **Clamped**, which restrains all degrees of freedom. Apply it to the geometry faces shown in Figure 4-1.

◆ **Load/BCs**

Action:	**Create**
Object:	**Displacement**
Method:	**Nodal**
New Set Name:	**Clamped**

| Input Data... |

Translation < T1 T2 T3 >	**< 0, 0, 0>**
Rotations < T1 T2 T3 >	**< 0, 0, 0>**

| OK |

Loads and B/C's on a 3-D Clevis

Select Application Region...

Geometry Filter: ◆ **Geometry**

Next, click on the **Surface** icon in the *Select Menu* as shown below
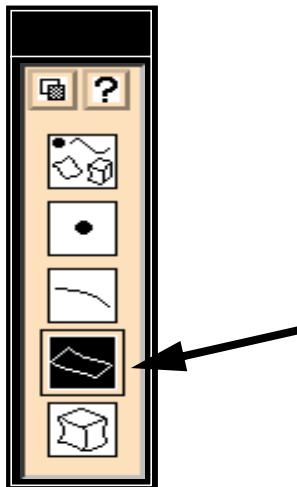
To prepare for the application of loads and boundary conditions, you need to orient the model to facilitate cursor picking. Click on the **Front View** icon from the *Main Form*.

Front View

In order to assure accurate and efficient picking, PATRAN offers various picking prferences. Here these preferences will be changed to best aid the picking to be made in the next step.

Preferences/Picking...

Rectangle/Polygon Picking: ◆ **Enclose entire entity**

Close

Hide Labels

Use the rectangle selection technique (click and drag) to choose the application region for the constraint.
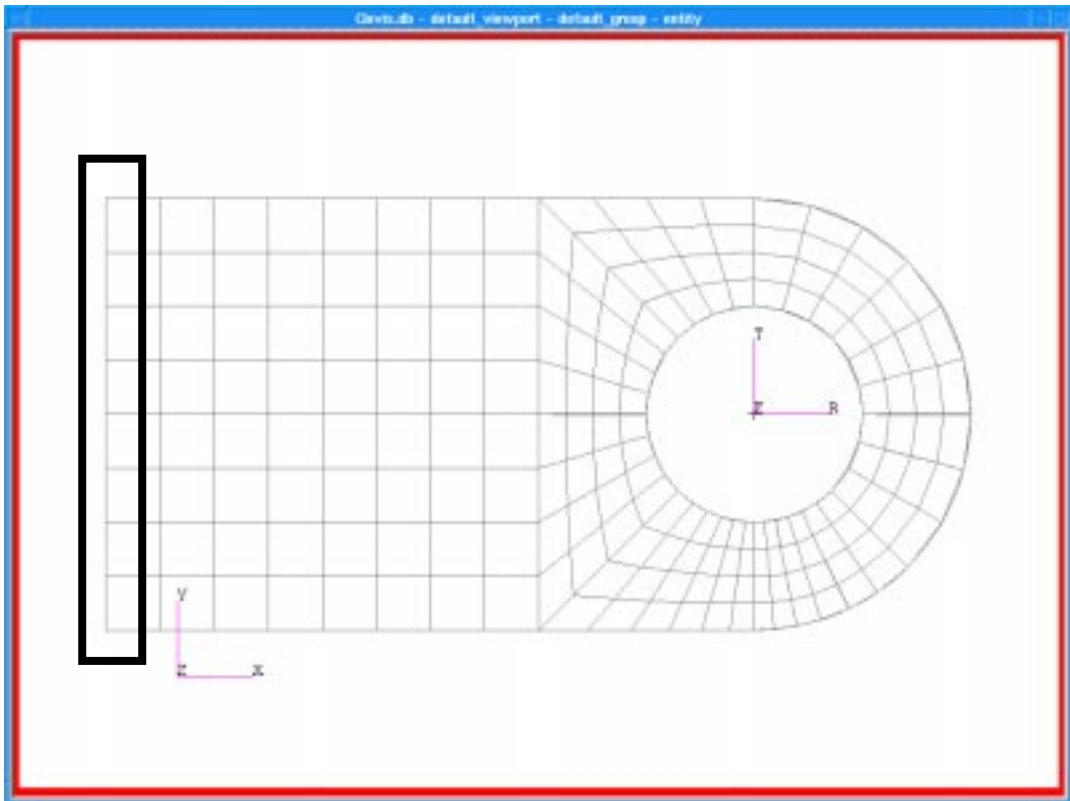
Add
OK
Apply

4. Create an applied load named **Vertical_load**, which uses the **Quadratic_load** field. Apply it to the solid faces along the bottom half of the holes.

◆ **Load/BCs**

Action:	**Create**
Object:	**Force**
Method:	**Nodal**

New Set Name:	**Vertical_load**

Input Data...

Force <F1 F2 F3>

Quadratic_load

OK

Select Application Region...

Be sure that the **Surface** icon is still highlighted in the *Select Menu.* Click in the *Select Geometry Entities* databox, and select the surfaces for the load. Use the polygon pick method to select the solid faces that bound the bottom half of the holes, as shown in the figure below..
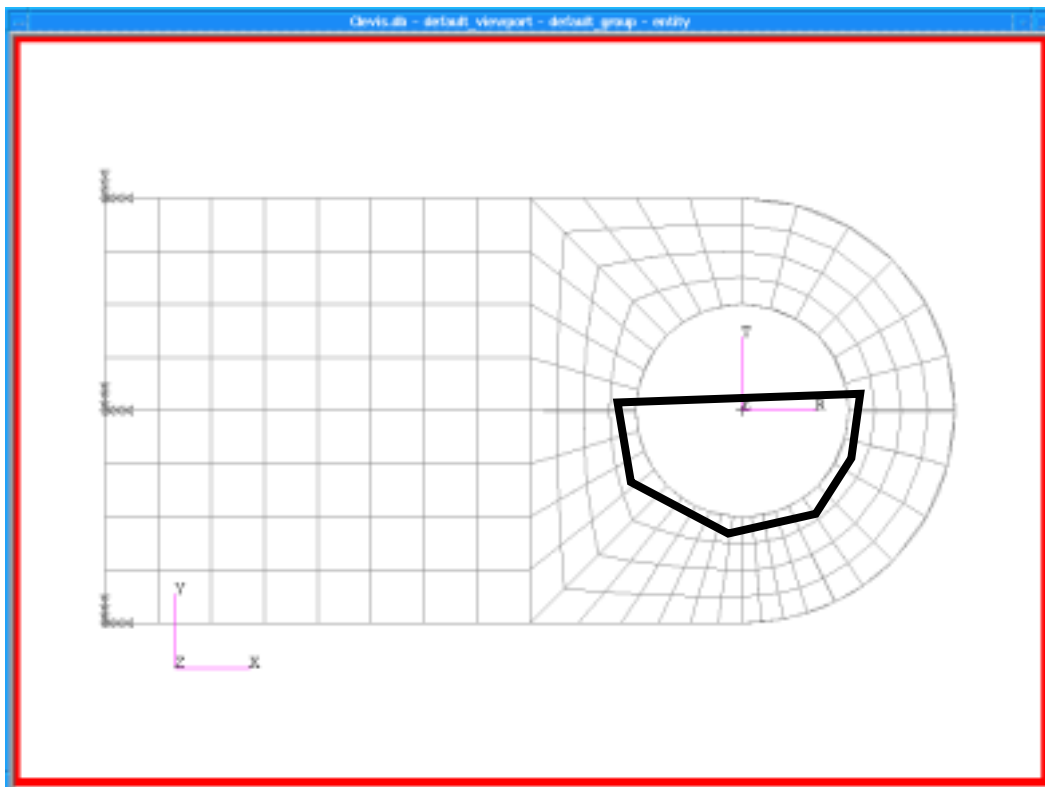
Add

OK

Apply

Vector markers indicating the applied load will appear as shown in the figure below.
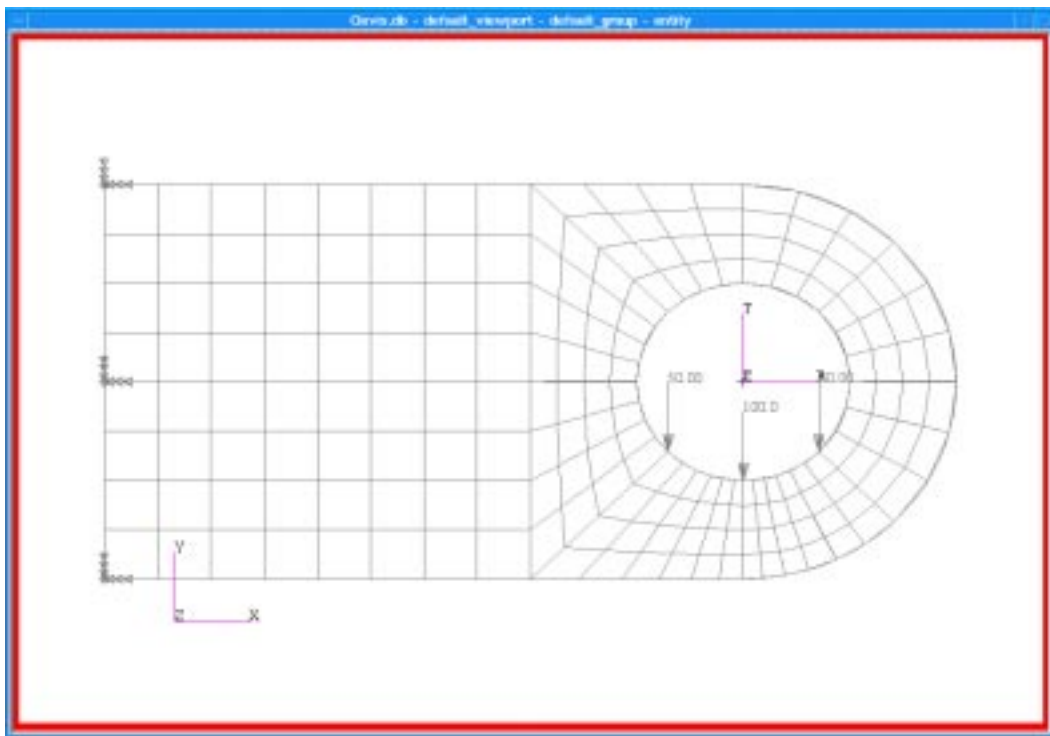
5. Display both the displacement and force on the finite element model..

Display/Load/BC/Elem. Props...

■ **Show on FEM Only**

Apply
Cancel

◆ **Load/BCs**

Action: **Plot Markers**

Assigned Load/BCs Sets:

Displ_Clamped
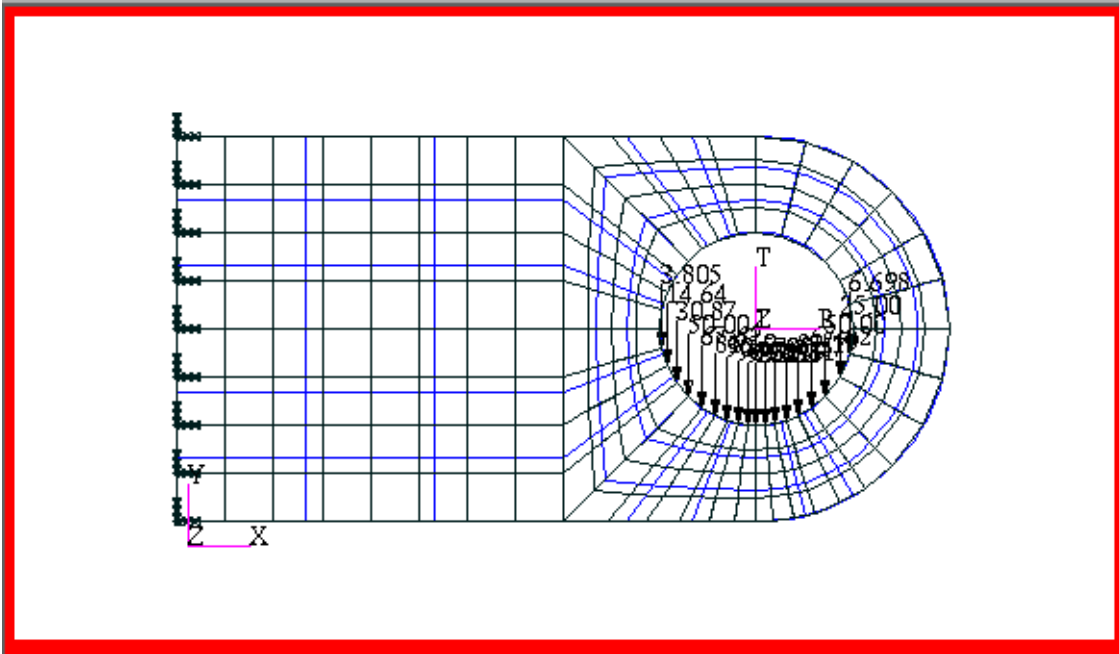Force_Vertical_Load

Select Groups: default_group

Apply

The loads and constraints should now be displayed at the nodal locations as shown below (orientation of the constraint arrows may vary).

To turn off the values:

Display/Load/BC/Elem. Props...

❑ **Show LBC/El. Prop Values**

Vectors/Filters...

■ **Scaled-Model Relative**

Apply

Cancel

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