LESSON 8

Post-Processing Modal Results of a Space Satellite

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5.39+00

mode 1 :
Max 5.39+00 @Nd 977
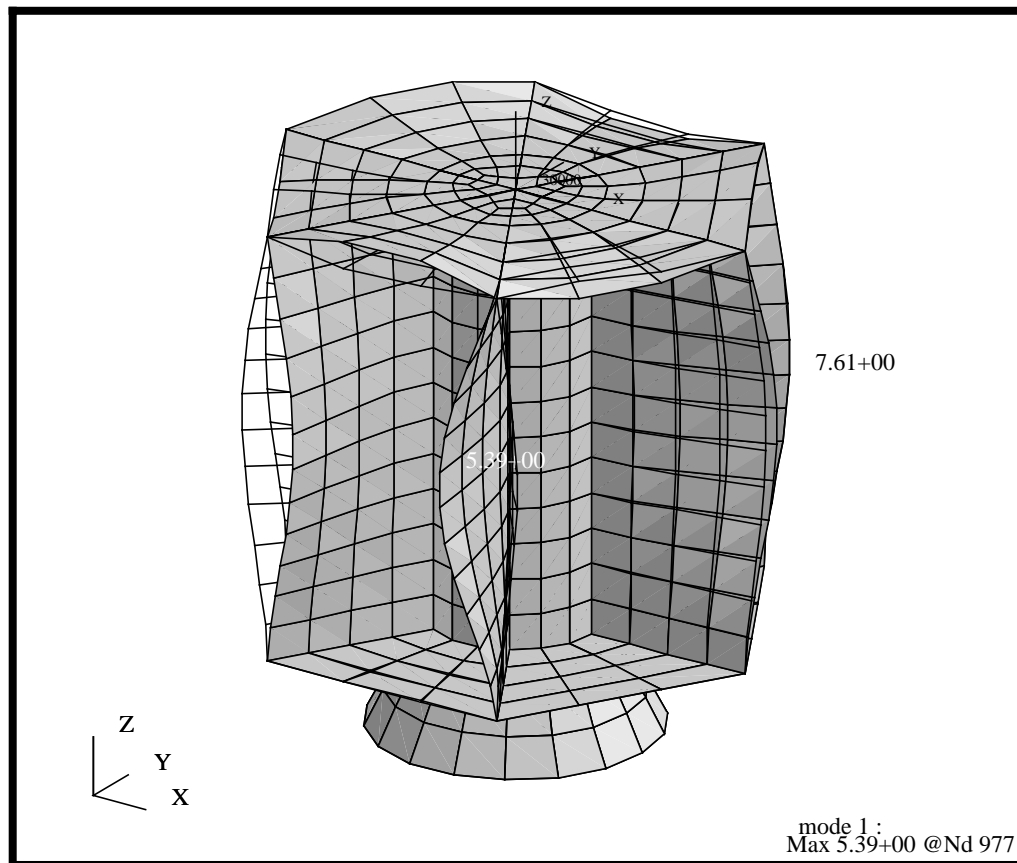
Objectives:

■ Post-process model results from an XDB file.

■ View and animate the eigenvector displacements of the
Satellite for two modes simultaneously.

Post-Processing Modal Results of a Satellite

Model Description:

In this exercise, you will examine the modal results of the Satellite. You will create mode shape plots of the model for modes 1 and 3. You will then animate modes 1 and 3 acting simultaneously. Also, you will be creating fringe plots of the percentage elemental strain energy for the Upper Platform. Finally, you will use shareware utilities to sum the elemental strain energies of Upper Platform.

Suggested Exercise Steps:

■ Start MSC/PATRAN and create a new database **modal_results.db**.

■ Change the *Tolerance to Default* and the *Analysis Code* to **MSC/NASTRAN**.

■ Import the Satellite database using **File/Import...** MSC/PATRAN DB and select the **satellite.db**.

■ Use the Analysis Form to Attach the modal XDB file you created in the previous exercise, **satellite_modal.xdb**.

■ Post only All Fem group, reset the graphics and reorient the model to Isometric view 3.

■ Create a deformed plot for Eigenvector 1. Under Deformation Results, modify the Display Attributes and Plot Options to change the display. Make the following changes under Display Attributes: Render Style = Shaded, turn Undeformed model off. Make the following changes under Plot Options: Save Deformation Plot As = mode 1.

■ Repeat the above procedure, but this time use mode 2. Make the following changes in Display Attributes: Deformed Color = Red, Render Style = Hidden Line, turn Undeformed model off. Make the following changes under Plot Options: Save Deformation Plot As = mode 2.

■ Now create a 3D Animation. Select DEF-mode 1 and change its Animation Method to Modal, then select Update Tool. (DO NOT HIT APPLY YET). Repeat this step for DEF_mode 2. Now hit Apply. With the 3D Graphics set on, you should be able to see both modes animating simultaneously.

■ Stop the Animation and Reset the Graphics.

■ Group post only the Upper Platform, unpost all other

groups.

■   Finally, Close and quit MSC/PATRAN.

Exercise Procedure:

1.   Open a new database and name it
     modal_results.db.

In this exercise, we will open a new database and import the model database into this database. We will then "attach" the MSC/ NASTRAN XDB results file to this database. Alternatively, we could have opened the **satellite.db** and "attached" the results into that database. Since we have chosen to separate the static from the modal results, we have made a conscious decision to separate the model data from the results as well as separate the results solutions.

File/New...

New Database Name | **modal_results** |

| **OK** |

New Model Preference

Tolerance   ◆ **Default**

Analysis Code: **MSC/NASTRAN**

| **OK** |

2.   Import the satellite database created in the previous Satellite exercise.

This step will import the model data from the original satellite database. All pre-processing information, such as Geometry, FEM, Loads & Boundary conditions, Materials, Element Properties and Groups will be imported into this database. We could use the MSC/ PATRAN Options to limit the content of what is brought into the new database. For this exercise, we will use the default and import all Entities into this database.

File/Import...

Object: | **Model** |

Source: | **MSC/PATRAN DB** |

Import File | **satellite.db** |
                              Note: this can be
                              selected from the
                              PATRAN Databases
                              list

> **Apply**

Once the import is completed, you will get a summary window listing all the PATRAN entities imported into the new database.

PATRAN Database Import   **OK**
Summary window

Access the XDB results data

3.   We will now access the modal results file.

When the MSC/NASTRAN input file was created for the modal solution, a MSC/NASTRAN XDB file was requested. With the results in this format, MSC/PATRAN does not import these results into the database, but instead, it accesses the file generated by MSC/NASTRAN. Only some basic results header information (types of results, location of the XDB file, etc.) gets stored in the PATRAN database. This saves time and disk space since the results are not duplicated inside MSC/PATRAN. Now "attach" the MSC/NASTRAN XDB file, **satellite_modal.xdb**.

◆ **Analysis**

Action: **Attach XDB**

Object: **Results Entities**

Method: **Local**

Select Results File...

Selected Results File   **satellite_modal.xdb** ↖

Note: this can be selected from the Available Files list

OK

Apply

4.   We will post the group to All-Fem, change the view to Isometric View #3 and the render style to Smooth shaded using the Toolbar icon.

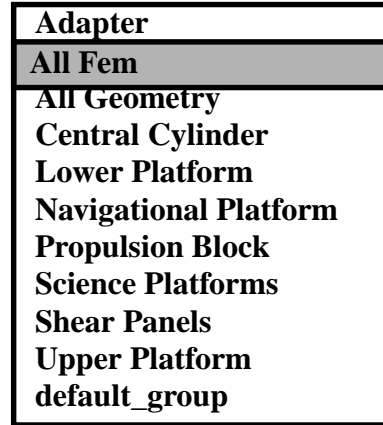From the Main Form, use the Reset Graphics to clear the display.

       Reset graphics

Post-Processing Modal Results of a Satellite

Post the All Fem group using Group Post

Group/Post...

Select Groups to Post

Adapter
All Fem
All Geometry
Central Cylinder
Lower Platform
Navigational Platform
Propulsion Block
Science Platforms
Shear Panels
Upper Platform
default_group

Apply
Cancel

Next reset the render style and view using the Toolbar Icons.
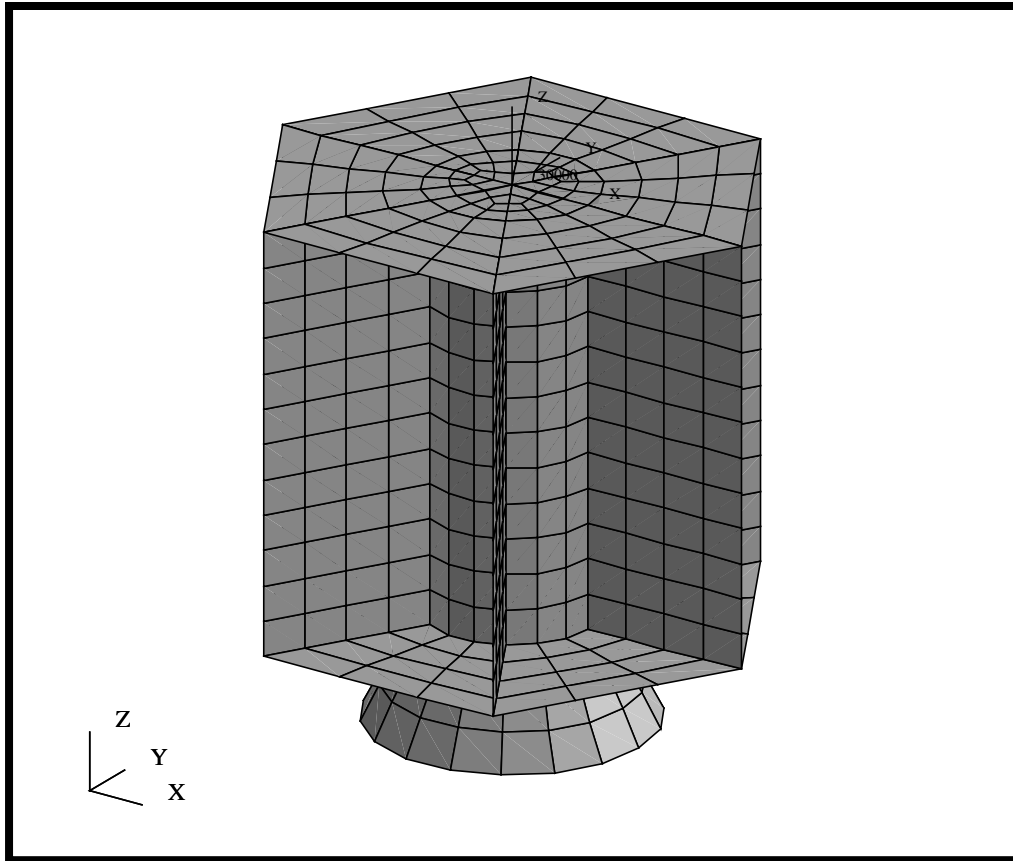
Isometric View 3   **Shaded Smooth**

Your model should look like the figure below

Figure 8.1. Imported Satellite Model ready for post processing

**Create a
Deformation
Plot of
Mode 1**

5.   Create a deformed shape plot of the **Eigenvector** result for mode 1.

We will now use results to make a deformed plot of the first fundamental mode for the Space Satellite. We will use the default plot options.

◆   **Results**

Action:	**Create**
Object:	**Deformation**
Select Result Case(s)	**SC1:LAUNCH MODAL, A1: Mode 1: Freq =**
Select Deformation Result	**Eigenvectors, Translational**

Apply

Your model should look like the one shown below

Figure 8.2. Default Eigenvector Deformation Plot
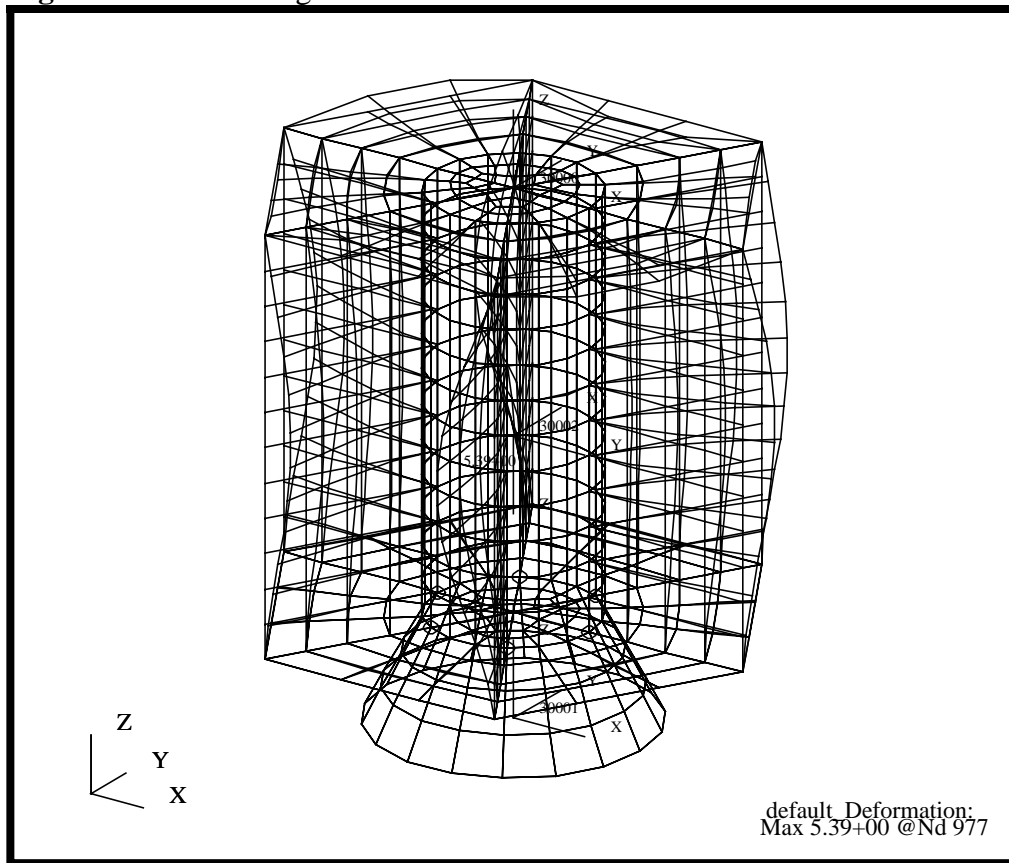
6.   Redo the plot of mode 1 with the undeformed model off and the render style set to shaded.

By default, the deformed and undeformed plots are superimposed. The deformed model is in white and the undeformed model is blue. Also, the deformed render style is set to Wireframe. Note, the maximum deformation is indicated in the lower right hand corner of the viewport as well as on the model.

Near the top of every result form is a set of Icons which are used to control the results display. The icons and forms they control will change depending on which type of result tool. These icons control the results selection, entities the results are to be applied on (targeted entities), results display specific to the type of result tool and animation setup.

**Recreate a
Deformation
Plot of
Mode 1**

From the Main Form, use the Reset Graphics to clear the display.

Reset graphics

The Display Attributes icon controls the appearance, scale factor and graphic options of any deformed plots created using the Deformation tool. Turn off the undeformed plot, change the render style to Shaded.

Deform Attributes

Render Style: **Shaded**

☐ **Show Undeformed**

Finally, give the plot a name using the Plot Options

Plot Options

Save Deformation Plot As: **mode 1**

Apply

By naming the plot, we can later post and unpost this plot using the results Action Post as well as superimpose other deformed plots (of different names) on top of this plot.

Your model should now look like the figure below. You will notice by turning off the undeformed entities and turning on the Shaded render style, the deformed plot becomes easier to visualize.

Figure 8.3. Eigenvector Deformation for Mode 1 in Shaded Render style.
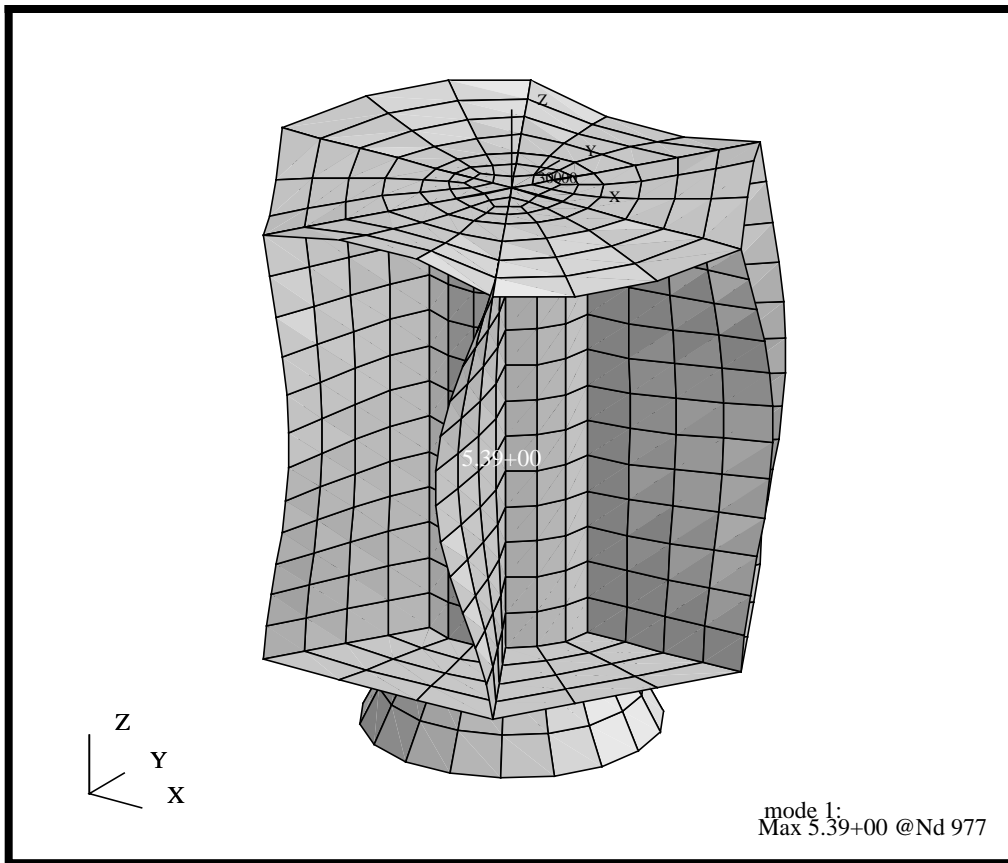
7. Create a deformation plot of the third mode.

We will create a second deformation plot of Mode 3.

Select Results

Start by selecting the third mode from the Result Cases.

Select Result Case(s)	**SC1:LAUNCH MODAL, A1: Mode 3: Freq =**
Select Deformation Result	**Eigenvectors, Translational**

Create a Deformation Plot of Mode 3

Change the Display Attributes so that the Deformation Color is set to Red, the Render Style is set to Hidden Line and the Undeformed model is turned off.

Deformed: **Yellow**

Render Style: **Hidden Line**

☐ **Show Undeformed**

Finally, give the third mode a name using the Plot Options

                                               Plot Options

Save Deformation Plot As: **mode 3**

**Apply**

Your model should look like the figure below. You will notice the second plot was superimposed on top of the first mode. This because we created to deformations with unique names, mode 1 and mode3.

You can choose to post only one plot by using the Results/Post functionality. For this exercise, we will want both deformations posted since we will be creating an animation of both modes in the next steps.

Figure 8.4. Simultaneous Display of the Eigenvector for Modes 1 & 3.

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Z
Y
X

mode 1:
Max 5.39+00 @Nd 977
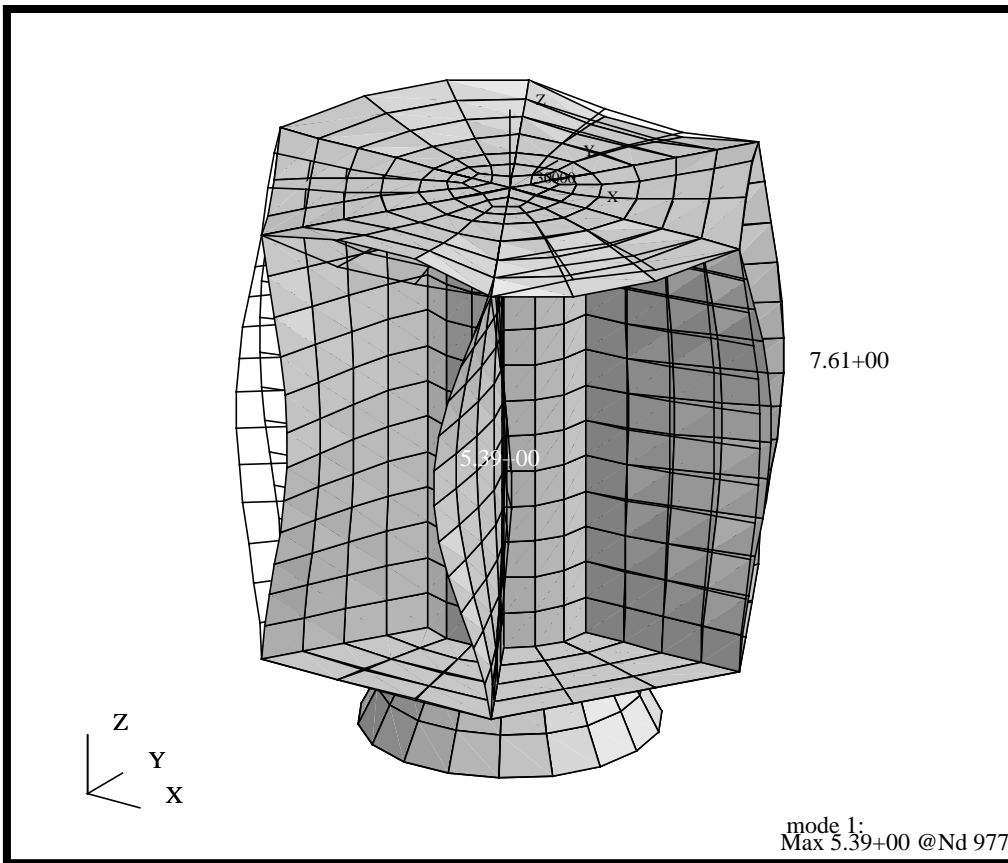
8.   Animate modes 1 and 3 simultaneously.

We will use the Animation tool to create a simultaneous animation of the eigenvectors deformations for modes 1 and 3 just created.

Create an Animation of Modes 1 & 3

Action:	**Create**
Object:	**Animation**
Method:	**3D Graphics**
Plots to Animate	**None-DEF_mode 1**
	None-DEF_mode 3
Animation Method:	**Modal**
Angle Offset:	**0.0**

Update Tool

| *Plots to Animate* | Modal-DEF_mode1 |
| | None-DEF_mode 3 |

| *Animation Method:* | Modal |

| *Angle Offset:* | 0.0 |

| **Update Tool** |

The model is now ready for animation. You will notice that each of the Plots to animate are now prefixed by the word "Modal", indicating they have been setup for a Modal type animation. A modal animation is an animation sequence which varies the results values (eigenvectors) from +Max to -Max values. Prior to animation, set the number of frames to 10.

| *Number of Frames:* | 10 |

| *Extrapolation:* | Linear |

| **Apply** |

MSC/PATRAN will now build the frames and start the animation. The *Animation Control* form will then be displayed. Once the model is animating, you can use the middle mouse button to rotate the model (only available when Animation Graphics is set to 3D). When you are finished, you can use the Stop Animation button on the Animation Control form to stop the animation.

| Stop Animation |

Post the Upper Platform Group

9. We will post the Upper Platform group, change the view to Front View and the render style to Wireframe using the Toolbar.

Post the Upper Platform group using Group Post

Group/Post...

Post-Processing Modal Results of a Satellite

Select Groups to Post

Adapter
All Fem
All Geometry
Central Cylinder
Lower Platform
Navigational Platform
Propulsion Block
Science Platforms
Shear Panels
Upper Platform
default_group

Apply

Cancel

Use the Plot/Erase form from the toolbar to Erase All Geometry.

**Plot/Erase form
(Display Menu)**

Erase All Geometry

OK

Next, from the Main Form, reset the graphics and change the view using the Toolbar Icons.
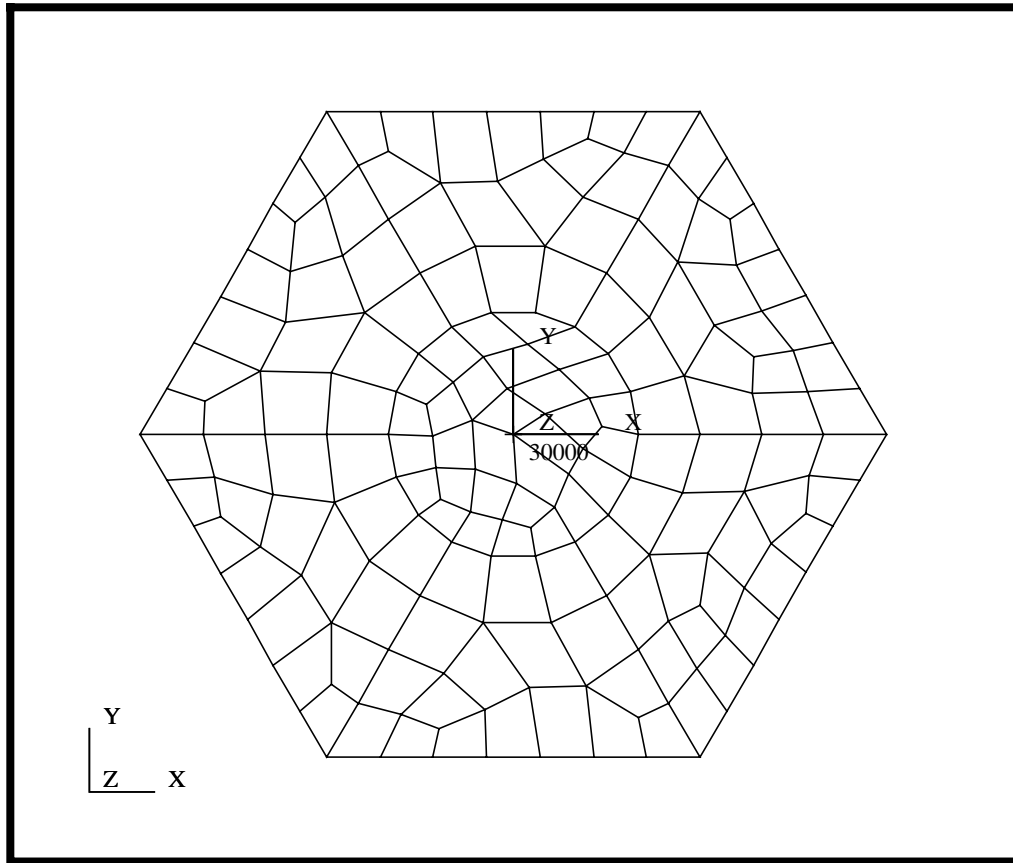

Reset graphics

Front view

Finally, your model should look like the figure below

Figure 8.5. Finite elements representing the Upper Platform

Create a Fringe Plot of the Eigenvector Translation Magnitude

10. Create a fringe plot of the Magnitude of the Eigenvector Translations for mode 1 for the Upper Platform.

We will now plot the Magnitude of the Eigenvector Translations for the Upper Platform. We will use a few different options to see the fringe result values combined with the colored fringe for the magnitude of the Eigenvectors.

Action:	**Create**
Object:	**Fringe**
Select Result Case(s)	**SC1:LAUNCH MODAL, A1: Mode 1: Freq =**
Select Fringe Result	**Eigenvectors, Translation**
Quantity	**Magnitude**

We will be using the default Target entities (all elements posted to the viewport), but we will change some of the additional display controls under Target Entities to control how the results get displayed on the targeted entities.

Target Entities

Additional Display Controls:

Edges

Lets modify the default display settings of the Fringe plot..

Display Attributes

Style:

Discrete/Smooth

Shading:

None

■ **Show Min/Max Label**
■ **Show Fringe Label**

Finally, give the plot a name using the Plot Options.

Plot Options

Save Fringe Plot As:

Eigenvector_mode1

Apply

This will create a fringe plot of the magnitude of the nodal eigenvector displacements for the Upper Platform. You will note that the fringe is displayed as an outline around the elements. This makes it easier to view the Fringe labels. Your plot should look like the figure below.

Figure 8.6. Fringe plot of Eigenvector Translation magnitudes.
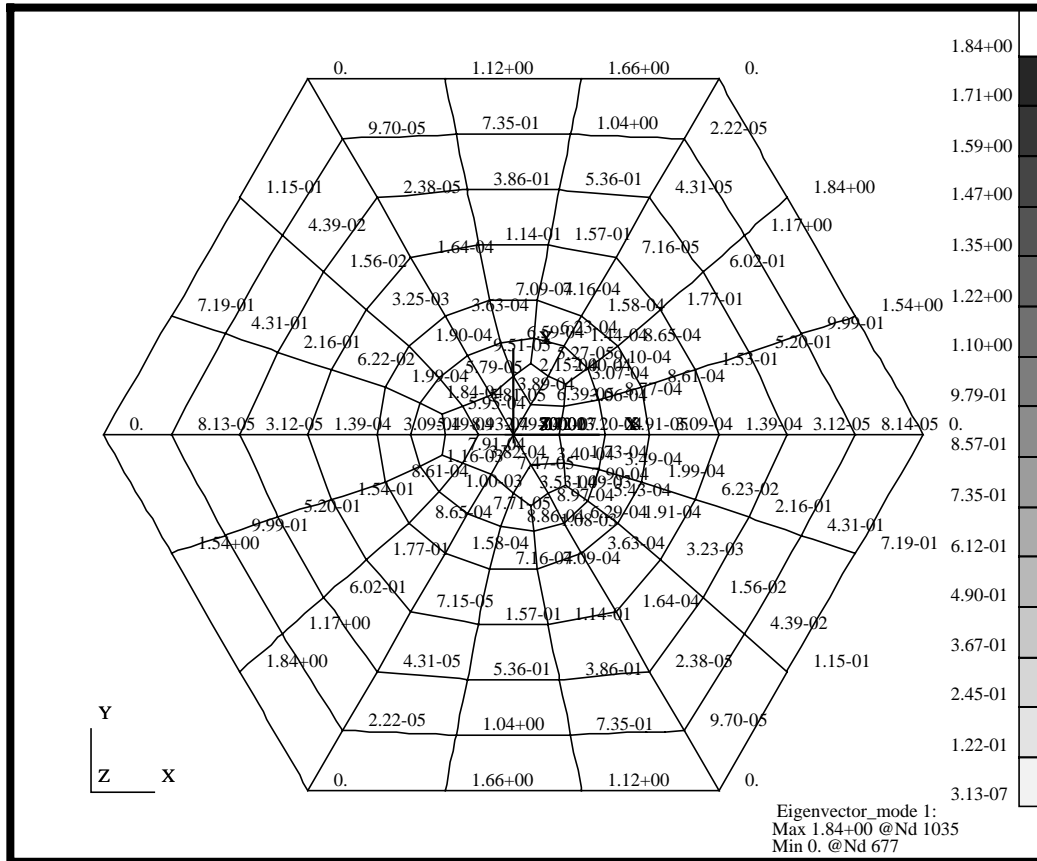
11.   To complete this exercise, you will close the database.

Close the Database and Quit Patran

File/Quit

This will exit MSC/PATRAN and close your file.