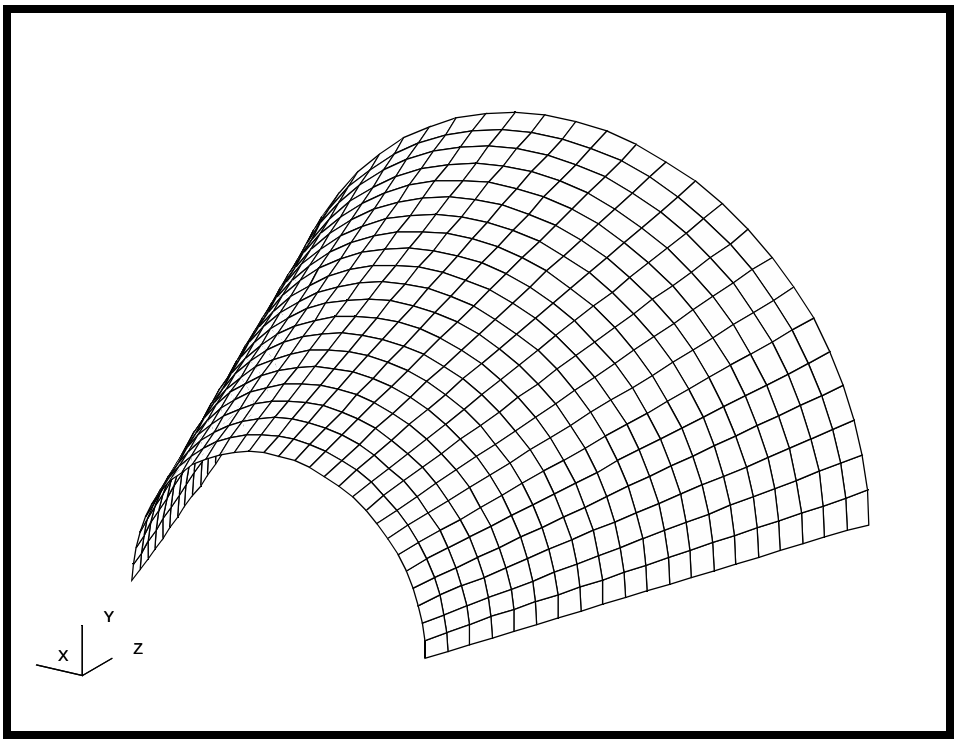
LESSON 17

Cylinder with T-Beam Stiffeners



Objectives:

- Create a cylinder and apply loads.
- Use the beam library to add stiffeners to the cylinder.

Exercise Procedure:

1. Open a new database. Name it **nozzle**.

Type **p3** in your xterm. The *Main Window* and *Command Window* will appear.

File/New ...

New Database Name: **nozzle**

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.

Tolerance: ◆ **Default**

Analysis Code: **MSC/NASTRAN**

Analysis Type: **Structural**

OK

2. Create a cylindrical coordinate frame.

◆ **Geometry**

Action: **Create**

Object: **Coord**

Method: **3 Point**

Type: **Cylindrical**

Apply

3. Create the geometry.

◆ **Geometry**

Action: **Create**

Object: **Curve**

Method: **XYZ**

Refer. Coordinate Frame:	select new system
Vector Coordinates List:	**<10, 0, 30>**
Origin Coordinates List:	**[10, 0, 0]**

Apply

Action:	**Create**
Object:	**Surface**
Method:	**Revolve**
Total Angle:	**12**
Curve List:	select curve

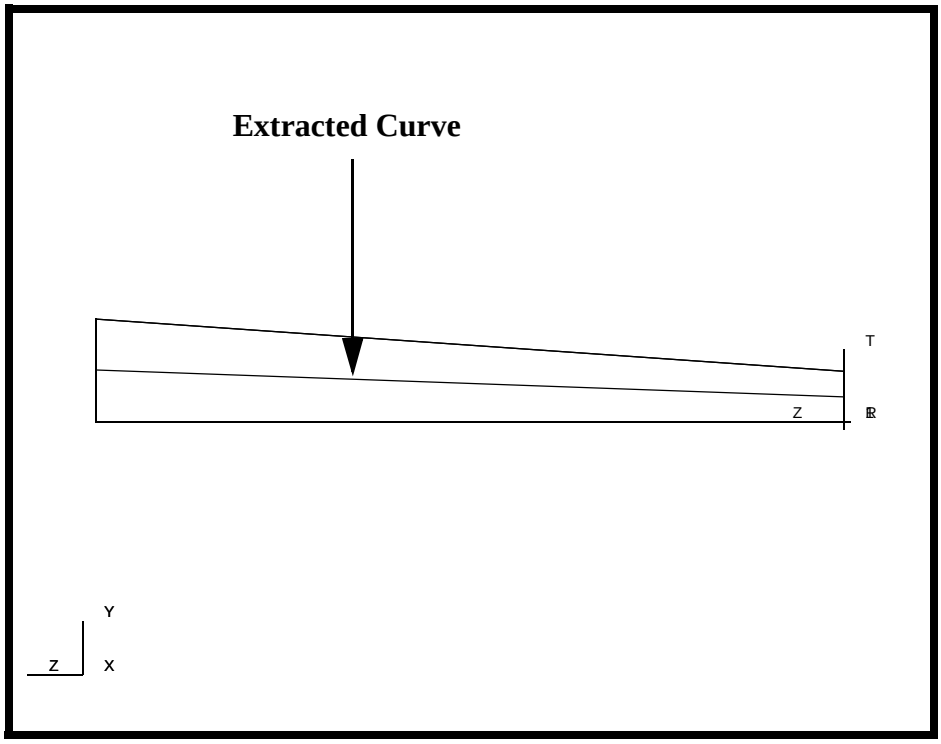
The function autoexecutes. Now, change the view by selecting the following toolbar icon:

Right Side View

4. Extract a curve down the middle of the model and scale it to 90%.

Action:	**Create**
Object:	**Curve**
Method:	**Extract**
Option:	**Parametric**
Curve Direction:	◆ **u Direction**
v Parametric Value:	**0.5**
Surface List:	select surface

The function autoexecutes.



Action:	**Create**
Object:	**Point**
Method:	**Extract**

◆ **Equal Arc Length**

u Parametric Value:	**0.5**
Curve List:	select extracted curve

The function autoexecutes and creates a point in the center of the extracted curve. To better see where this point is located, turn on labels using the following toolbar icon:

Action:	**Transform**
Object:	**Curve**

Method:	**Scale**
Origin of Scaling:	select extracted point
Scale Factor:	**0.9, 1.0, 0.9**

■ **Delete Original Curves**

Curve List:	select extracted curve

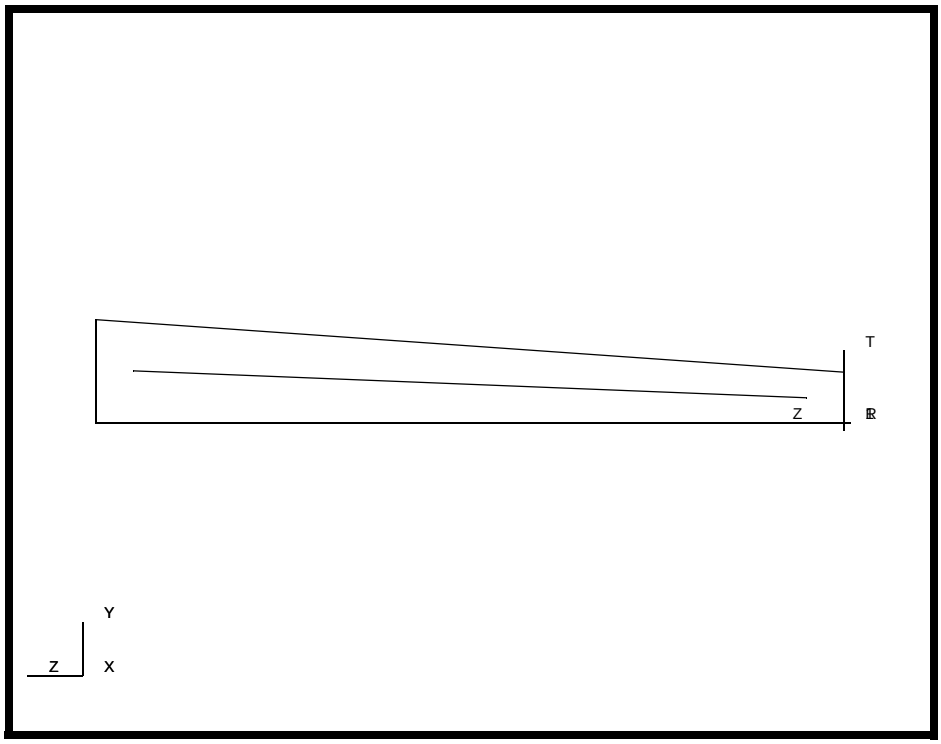
The function autoexecutes. When prompted if you wish to delete the original curves, respond with:

Yes

Clean up the display using the following icons:

Refresh Graphics

Hide Labels

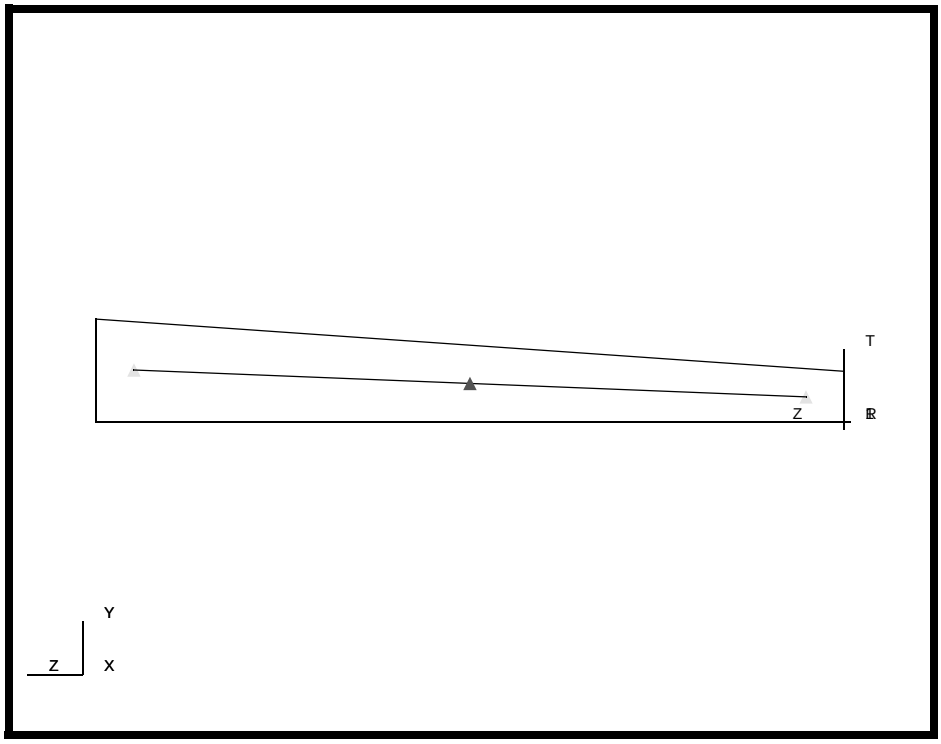


5. Associate the curve to the surface.

Action:	**Associate**
Object:	**Curve**

Method:	**Surface**
Curve List:	select extracted curve
Surface List:	select surface

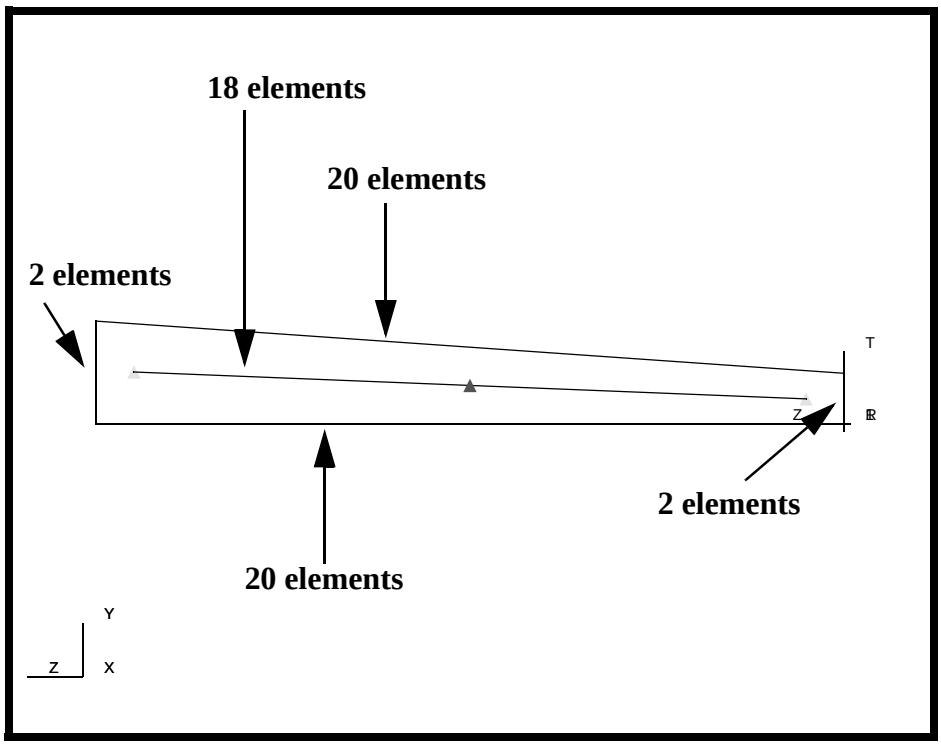
The function autoexecutes. The curve is now associated with the surface, as indicated by the triangle.



6. Mesh the model.

◆ **Finite Elements**

Action:	**Create**
Object:	**Mesh Seed**
Type:	**Uniform**
Number of Elements:	**18**



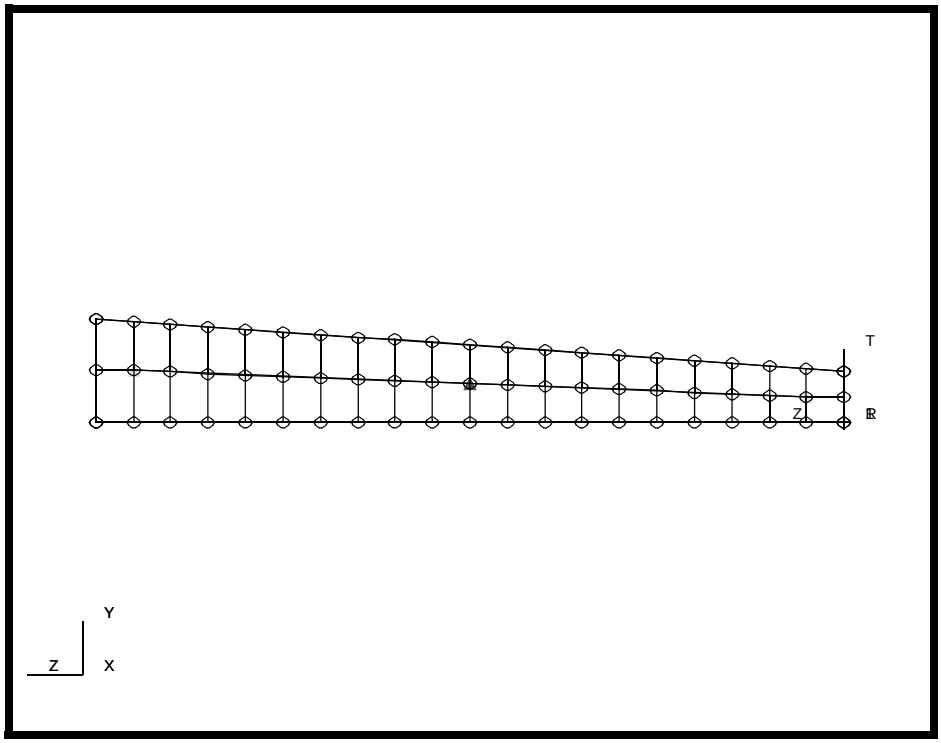
Curve List:	select associated curve
Apply	
Number of Elements:	**2**
Curve List:	shift click to select left and right edge
Apply	
Number of Elements:	**20**
Curve List:	shift click to select top and bottom edge
Apply	
Action:	**Create**
Object:	**Mesh**
Type:	**Surface**
Global Edge Length:	**4**

Mesher: ◆ **Paver**

Surface List: select surface

Apply

The model should now be meshed as follows:



7. Create the material **alum**.

◆ **Materials**

Action: **Create**

Object: **Isotropic**

Method: **Manual Input**

Material Name: **alum**

Input Properties...

Elastic Modulus: **10.0E6**

Poisson's Ratio: **0.3**

Density:	**.101**

Apply

Cancel

8. Create two fields to be used for the model. One will represent the thickness, and the other wil be used to apply a sinusoidally varrying pressure.

First, create the field **thickness**.

◆ **Fields**

Action:	**Create**
Object:	**Spatial**
Method:	**PCL Function**
Field Name:	**thickness**
Field Type:	◆ **Scalar**
Coord. System Type:	◆ **Real**
Coordinate System:	select cyl. coord. system
Scalar Function (‘R ‘T ‘Z):	**0.15+0.0025*’Z**

Apply

Now, create the field **edge_load**.

Action:	**Create**
Object:	**Spatial**
Method:	**PCL Function**
Field Name:	**edge_load**
Field Type:	◆ **Scalar**
Coord. System Type:	◆ **Real**
Coordinate System:	select cyl. coord. system
Scalar Function (‘R ‘T ‘Z):	**100*sinr(’Z)**

Apply

9. Create the element properties for both the cylinder and the T-beam stiffener.

First, create a 2D shell property called **plate** for the cylinder.

◆ **Properties**

Action:	**Create**
Dimension:	**2D**
Type:	**Shell**
Property Set Name:	**plate**

Input Properties...

Material Name:	**alum**
Thickness:	**f:thickness**

OK

Select Members:	select surface

Add

Apply

Next, create a property set called **stiffener**.

Action:	**Create**
Dimension:	**1D**
Type:	**Beam**
Property Set Name:	**stiffener**

Input Properties...

■ **Associate Beam Section**

Click OK on the Associate Beam Message.

OK

Click on the following icon to create the beam cross section:

New Section Name: **t_section**

Click on the following section type icon:

T-Section

W: **1.0**

H: **1.0**

t1: **0.1**

t2: **0.08**

Calculate/Display

When done viewing the diminsional specifications, close the form.

Close

OK

Material Name: **alum**

Bar Orientation: **<1, 0, 0> Coord 1**

OK

Select Members: select associated curve

Add

Apply

10. Create the sinusoidal pressure load called **press**.

◆ **Loads/BCs**

Action: **Create**

Object: **Pressure**

Type: **Element Uniform**

New Set Name: **press**

Target Element Type: **2D**

Input Data...

Top Surf Pressure: **f:edge_load**

OK

Select Application Region...

Select Surfaces or Edges: select surface

Add

OK

Apply

11. Change the view of the model to better display the applied pressure.

Viewing/Angles ...

Angle: **-42, -69, -3**

Apply

Cancel

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

Vectors/Filters ...

Length: ◆ **Scaled - Screen Relative**

Scale Factor: **0.1**

■ **Show LBC/El. Prop. Values**

Apply

Cancel

■ **Show on FEM Only**

■ **Show LBC/El. Prop. Vectors**

Apply

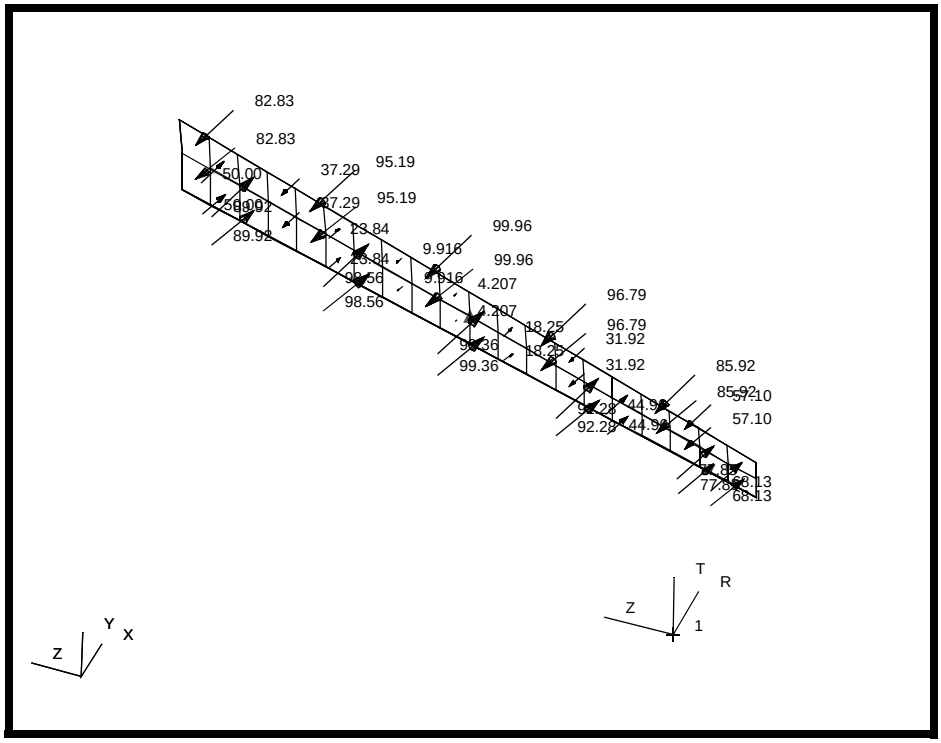
Cancel

If the pressure load is not seen on the screen, plot it by doing the following:

Action:	**Plot Markers**
Assigned Load/BC Sets:	**Press_press**
Select Groups:	**default_group**

Apply

The following should now be seen:



12. Transform the model by rotating the surface about the cylindrical axis.

Group/Transform ...

Action:	**Transform**
Method:	**Rotate**

Properties:	**Transform**
Reference Coord. Frame:	select cyl. coord. system
Rotation Angle:	**12.0**
Repeat Count:	**14**

Apply

Cancel

This leaves the screen a little messy, though, with all the loads applied. Clean up the display by doing the following:

Display /Loads/BCs/El. Props...

Loads/BCs:	**Hide All**

Apply

Cancel

13. Equivalence the nodes of the model that you just rotated.

◆ **Finite Elements**

Action:	**Equivalence**
Object:	**All**
Method:	**Tolerance Cube**

Apply

14. Show the properties of the shell thickness.

◆ **Properties**

Action:	**Show**
Select Property:	**Thickness**
Display Method:	**Scalar Plot**
Select Groups:	

◆ **Current Viewport**

default_group

Apply

To get a better view of the curvature of the model, select the following toolbar icon:

Smooth Shaded

Close the database.

File/Close...

This ends the exercise.