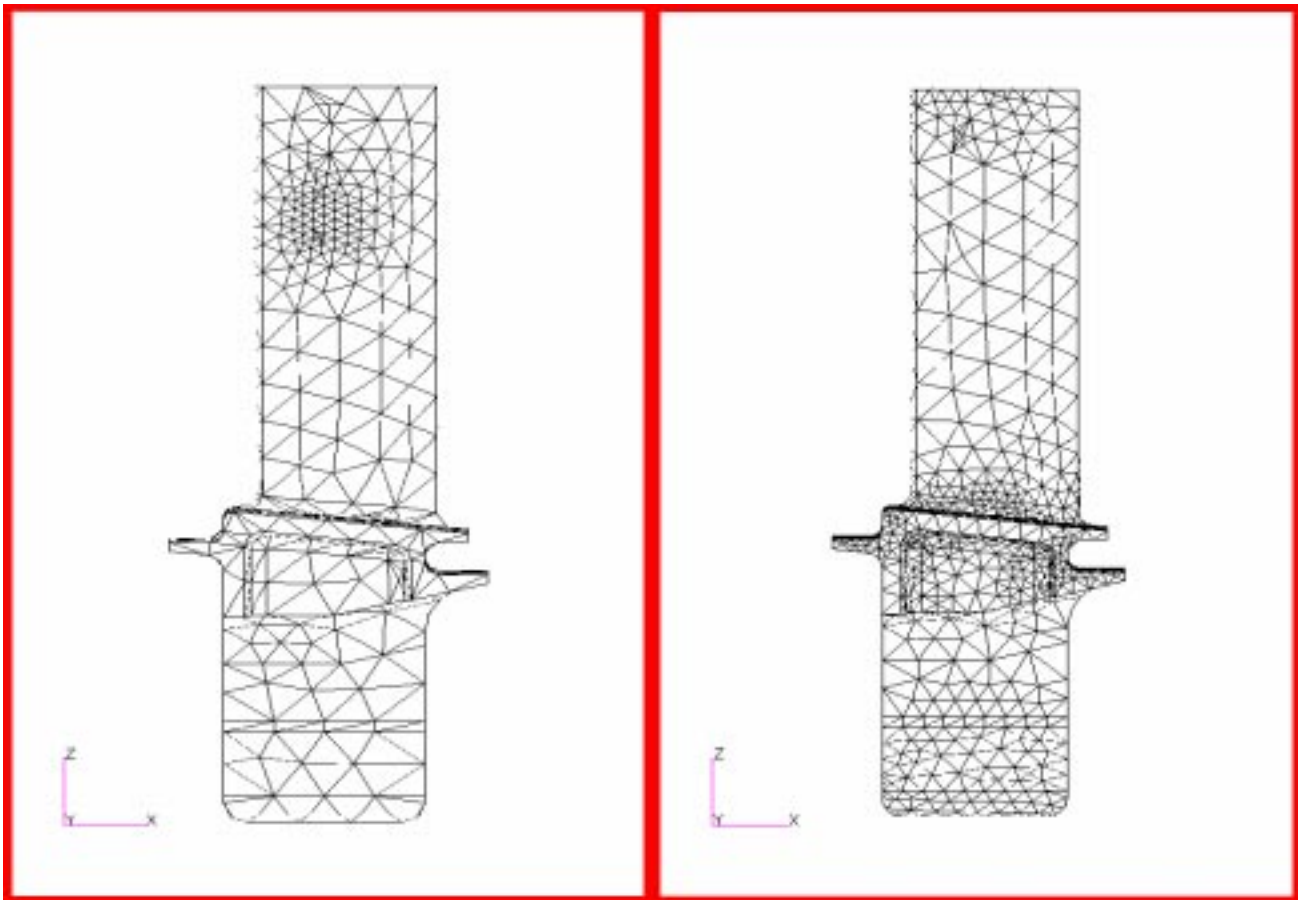


Lesson 11

Curvature Based Tetmeshing



Objective:

- To use Allowable Curvature Error.
- To show the advantages of meshing with curvature check. Then comparing the differences of using a smaller tolerance between two meshes, using the Allowable Curvature Error function.



Suggested Exercise Steps:

- Create a new database named `tetmesh_curvature.db`.
- Change the Tolerance to **Default** and the Analysis Code to **MSC/NASTRAN**.
- Import Unigraphics solid, Create two groups **no_curv_chk** and **curv_chk**.
- Tetmesh both solids, one with no curvature check and the other with a curvature check of 0.1. Then delete the curvature check solid mesh and remesh with a curvature check of 0.05.
- Compare the differences in mesh at points of curvature. Be sure to notice the similarities of mesh size at locations where there is little or no curvature.

Exercise Procedure:

1. Create a **New Database** and name it `tetmesh_curvature.db`.

File/New Database...

New Database Name

`tetmesh_curvature`

OK

2. Change the *Tolerance* to **Default** and the *Analysis Code* to **MSC/NASTRAN** in the *New Model Preferences* form. Verify that the *Analysis Type* is **Structural**.

New Model Preference

Tolerance

◆ **Default**

Analysis Code:

MSC/NASTRAN

Analysis Type:

Structural

OK

**Importing
Unigraphics
solid**

3. Import the Unigraphics solid that is to be tetmeshed.

File/Import...

Source:

Transfer Method:

Unigraphics Options...

Entity Types:

All Layers

Layer numbers

Place each layer in a separate group under Group Classification menu.

Group Classification...

Group Name to Create

Group Entity Types:

All Layers

Layer numbers

Apply

Repeat above steps for group name **curv_chk** and layer 5, then, Cancel.

OK

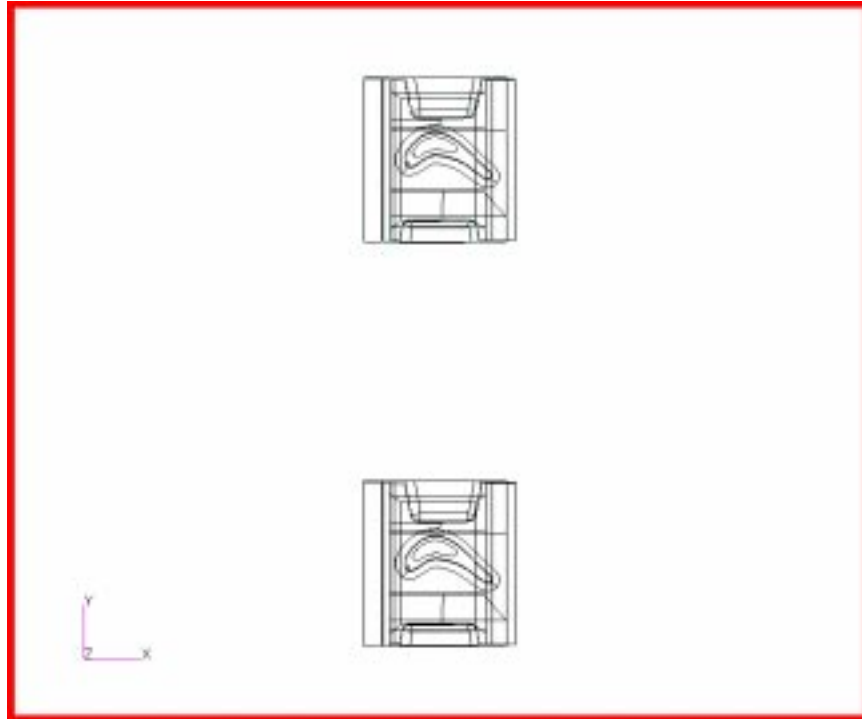
Import File:

Apply

Click OK on the Import Summary Form.

OK

The PATRAN viewport should look like the following:



4. Create another viewport, with each solid displayed in a separate one.

Viewport/Create...

New Viewport Name

Notice that viewport vp2 is current (red boarder)

Group/Post...

Select Groups to Post

**Create
Second
Viewport**

Make viewport default_viewport current by clicking just inside it's border.

Group/Post...

Select Groups to Post:

no_curv_chk

Apply

Cancel

Viewport/Tile...

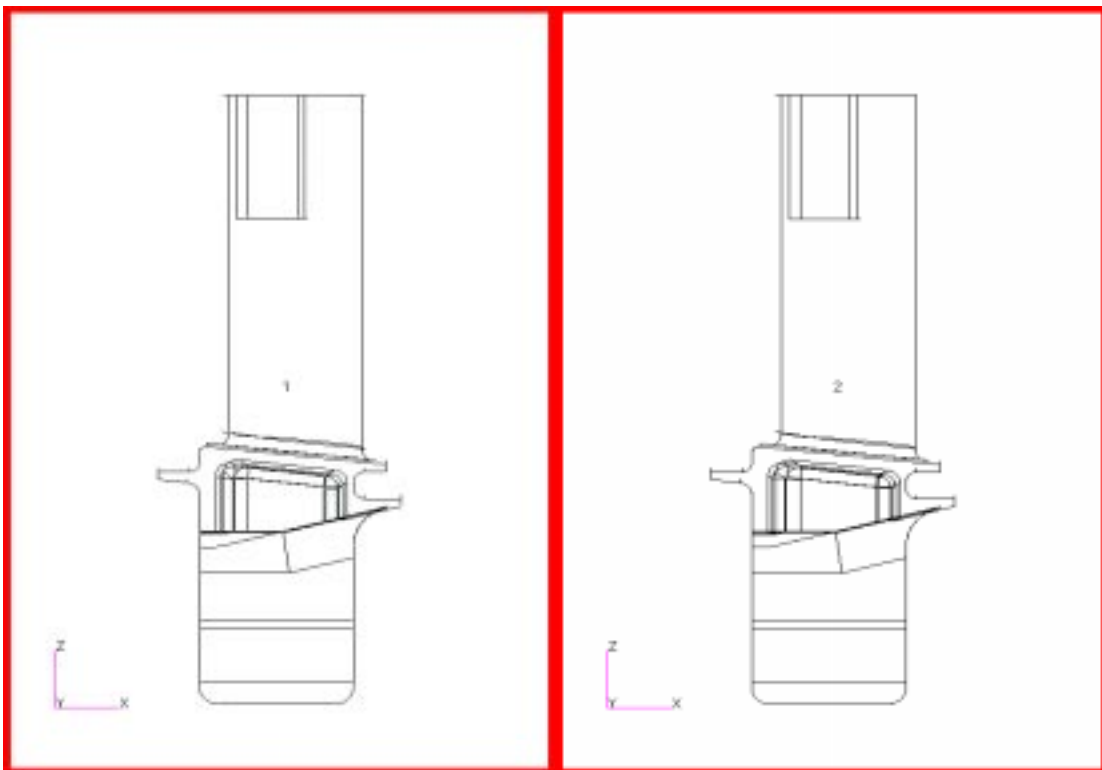
Change view using toolbar icon



Fit the solids to the viewports using the toolbar

Turn on the solid labels so you can see what solids are posted in the two viewports.

The PATRAN view ports should look like the following:



Curvature Based Tetmeshing

- Tet mesh both solids, the first solid without Allowable Curvature Error and the second with Allowable Curvature Error set to 0.1 . Make the default_viewport current.

◆ Finite Elements

Action:

Object:

Type:

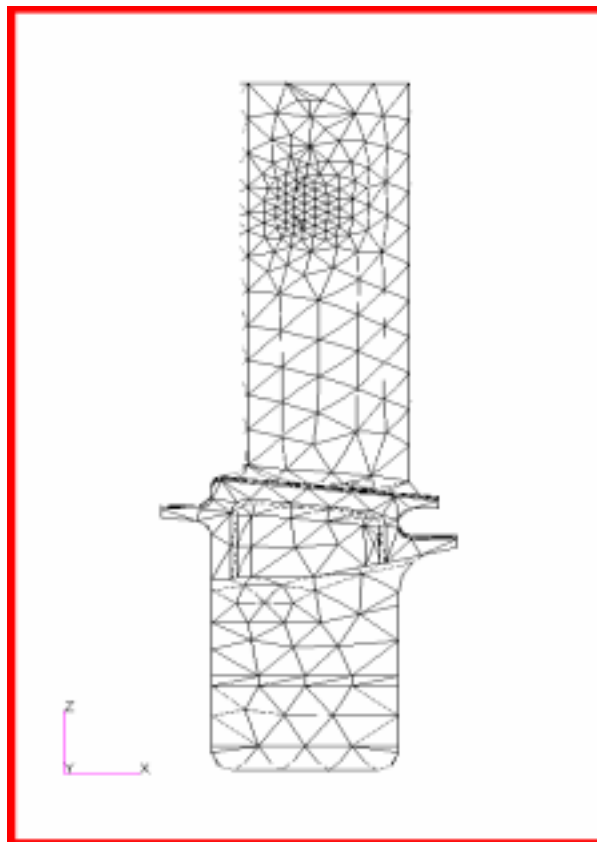
Global Edge Length

Mesher

Element Topology:

Input List

Erasing the geometric solid **Solid 1** and shading, the tet mesh will appear in viewport default_viewport, as shown below.



Now, tet mesh the other solid, Solid 2, using the same value for the Global Edge Length, but use a curvature check of 0.1. Set vp2 as current viewport.

<i>Action:</i>	Create
<i>Object:</i>	Mesh
<i>Type:</i>	Solid
<i>Global Edge Length</i>	0.25
<i>Mesher</i>	TetMesh
TetMesh Parameters...	
■ Curvature Check	
<i>Max h/l</i>	0.10
OK	
<i>Element Topology:</i>	Tet10
<i>Input List</i>	Solid 2
Apply	

The tet mesh will appear in viewport vp2.

NOTE: The smallest curvature based refinement is 1/5th of the global element size (GEL).

Comparing Meshes

6. Compare the two tet meshes to see the effect of the curvature check.

Zoom in (use current view, X-Z plane) enough so it is possible to see the transitioning mesh at the bottom of the blade and going into the blade support for both models.

Also, look at the different portions of the models, (i.e. X-Z plane, Y-Z plane, and Y-X plane at bottom of blade support).

In general, the element edge lengths are similar for both meshes for regions away from those with high curvature. For regions with high curvature there are more layers of elements for the tet mesh with greater mesh curvature control, e.g. Max h/L=0.10 .

Curvature Based Tetmeshing

7. Create a new tetmesh using a smaller curvature check parameter value. Delete the second mesh and remesh with Allowable Curvature Error set to 0.05.

<i>Action:</i>	<input type="text" value="Delete"/>
<i>Object:</i>	<input type="text" value="Mesh"/>
<i>Type:</i>	<input type="text" value="Solid"/>
<i>Solid List</i>	<input type="text" value="Solid 2"/>

<i>Action:</i>	<input type="text" value="Create"/>
<i>Object:</i>	<input type="text" value="Mesh"/>
<i>Type:</i>	<input type="text" value="Solid"/>
<i>Global Edge Length</i>	<input type="text" value="0.25"/>
<i>Mesher:</i>	<input type="text" value="TetMesh"/>

Curvature Check

<i>Max h/l</i>	<input type="text" value="0.05"/>
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<i>Element Topology:</i>	<input type="text" value="Tet10"/>
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<i>Input List</i>	<input type="text" value="Solid 2"/>
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8. Compare the two meshes, one without curvature checking and with one curvature checking.
9. Close the PATRAN database and quit PATRAN.

