

harpoon

Quick Start Guide

Introduction

Harpoon is a fully automatic body-fitted hex-dominant mesher. It represents a paradigm shift towards the automation of mesh generation by removing the CAD clean up step and the need for a surface mesh.

Employing a modified Cartesian-Octree meshing technique, scalable speeds of up to 2 million cells per minute are common. Tolerant to geometry errors such as holes and intersecting surfaces while producing a Hex dominant mesh, Harpoon provides significant benefits to all areas of CFD/FEA research.

Set up the various parameters that you require for your mesh in advance then grab a coffee while Harpoon produces your mesh!

Meshing Style

Harpoon uses different size hexas (levels) to control the detail of the final mesh. As the level increases, the size of the hexas decrease by a factor of two (ie level 4 is half the size of level 3). The Base Level is the minimum level to which Harpoon will mesh.

Multiple levels can be assigned to different parts, surfaces, feature lines and refinement boxes which when combined with different expansion rates give precise management over the way in which Harpoon generates your mesh.

Harpoon is tolerant to a large amount of geometry errors but there are STL clean up tools such as automatic hole finding if needed.

Once the mesh is generated there are various methods for inspecting the quality such as clipping plane, mesh stats and mesh quality histograms. Smoothing algorithms, surface recovery and hole finding functions are available to help you validate the mesh prior to export.

This QuickStart Guide is designed to take you through some of Harpoon's basic functions so that you will have a good idea of how to generate a mesh with your own data.

If you are unsure of anything or have a problem please contact you local distributor

<http://www.sharc.co.uk/html/buy.htm>

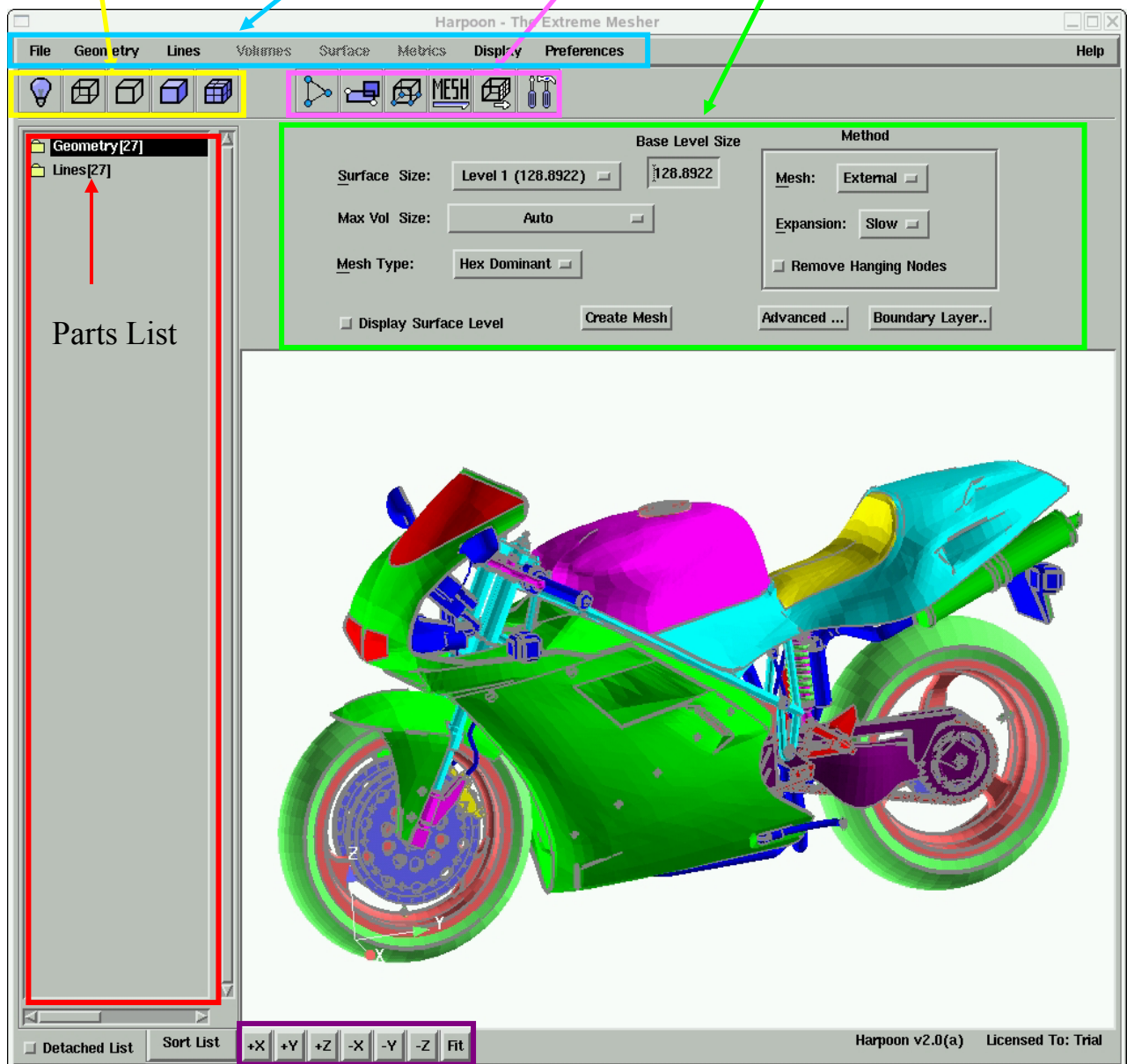
GUI Overview

Display Icons

Menu Bar

Process Icons

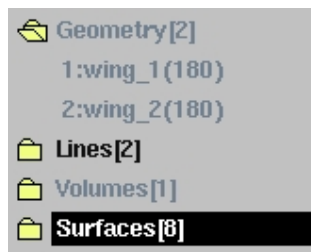
Process Area



Quick View Icons

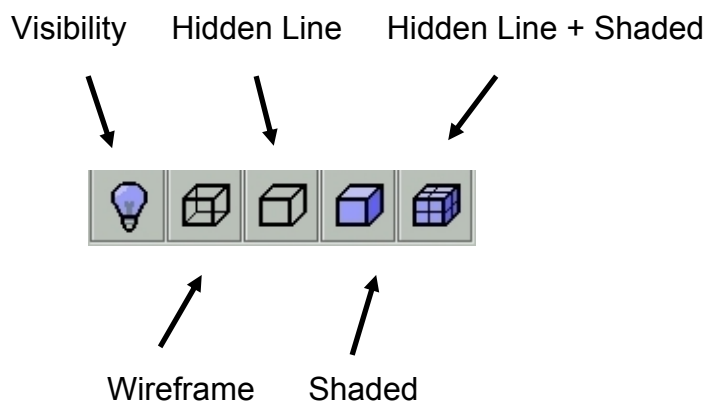
Icons

Harpoon works through a series of folders which contain parts. The parts list is located to the left of the screen and contains 4 folders (when mesh present).

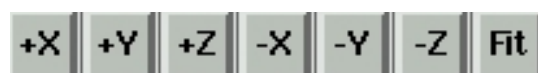


Actions can be applied to the parts as a group or to individual parts. Geometry folder contains the imported geometry. Double clicking this folder will give you access to the individual parts themselves. Feature lines that are extracted on importing the geometry or imported from a file are contained in the Lines folder. The Volume Mesh(s) are contained in the Volumes folder and the Surface Mesh(s) (including farwalls) are contained in the Surface folder.

There are several display options are available



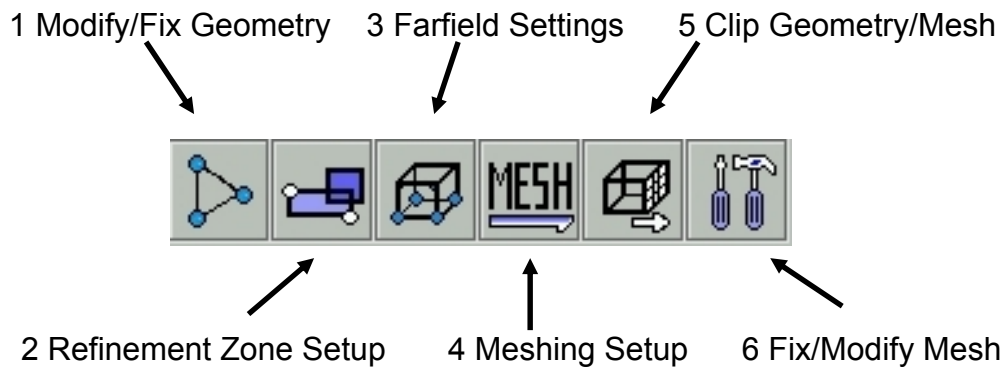
To assist manipulation of the geometry quick views are available in the bottom left of Harpoon.



Clicking these will re-orientate the display so that quickly move around the geometry.

Icons

The mesh icons are located towards the centre of the GUI are organised in such a way as to simulate the process flow through Harpoon.



Clicking on each icon will update the Process area to reflect the options that are available.

1 – Modify/Fix Geometry

Clean up your geometry by moving nodes and finding and filling holes.

2 – Refinement Zone Setup

Control the mesh using of areas of refinement according to a range of geometric shapes (cube, sphere, trapezoid)

3 – Farfield Settings

Change the location volume that Harpoon will mesh

4 – Meshing Setup

Define the settings for the mesh that you wish to generate.

5 – Clip Geometry/Mesh

Inspect the geometry and generated mesh using clipping functions.

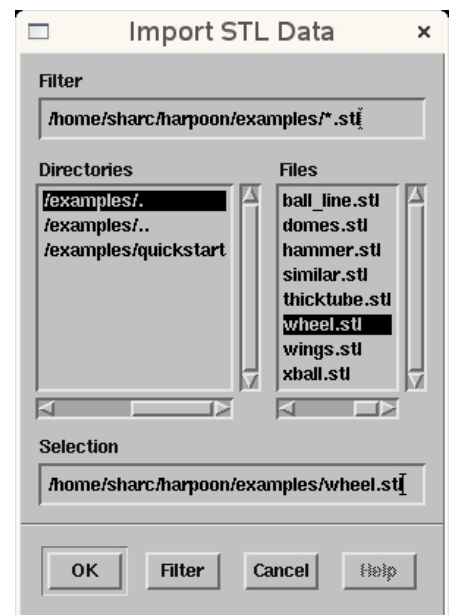
6 – Fix/Modify Mesh

Fill holes, modify the mesh and smooth using a selection of automatic and manual features.

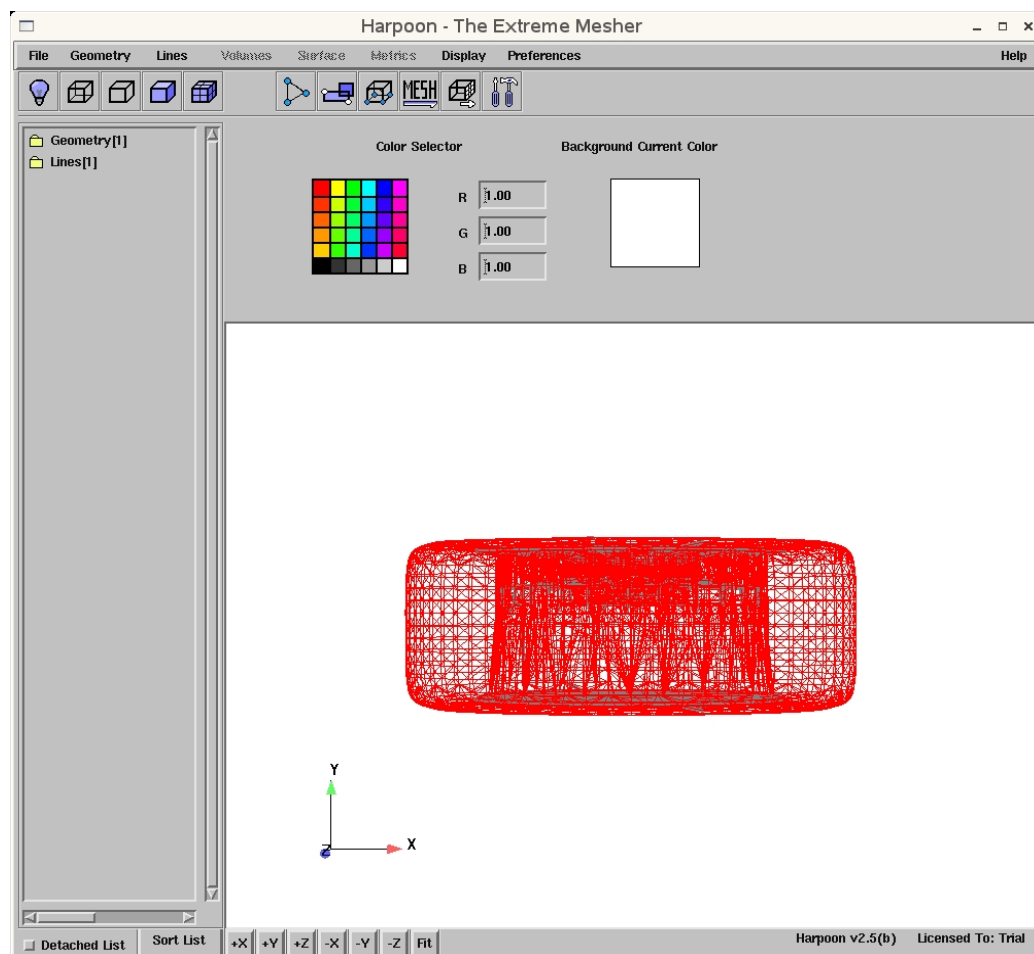
External Meshing

Loading Data

1. Launch Harpoon.
2. From the File menu select **Import – STL**
3. Navigate to SHARC_HOME/examples
4. Select **wheel.stl** and click ok



The imported geometry will be displayed in the graphics window of Harpoon



External Meshing

Setting Mesh Options

- Click the **Mesh** icon



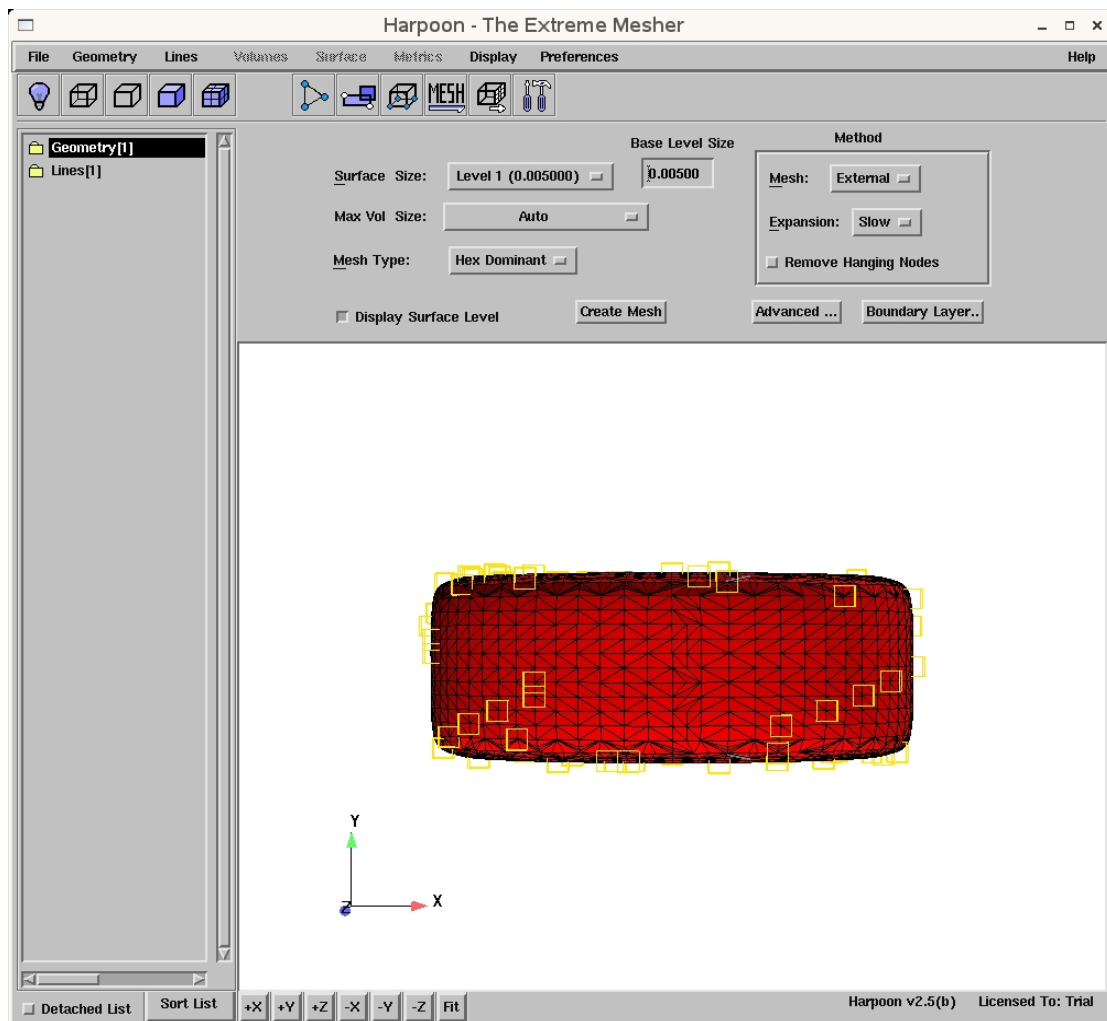
- Check the **Display Surface Level** Box

☐ Display Surface Level

The yellow hexas displayed on the screen represent the smallest cells that Harpoon will attempt to place on the surface. Their size is controlled by the Base Level. A smaller Base Level will capture the geometry with a higher degree of accuracy but will result in more cells while a larger Base Level will result in less cells but a more approximated surface mesh.

- Change the **Base Level** to 0.005 and press return.

You will see that the yellow hexas have increased in size.



External Meshing

Setting Farfield

8. Click on the Farfield Settings icon



9. Check the Min Z Box as shown below

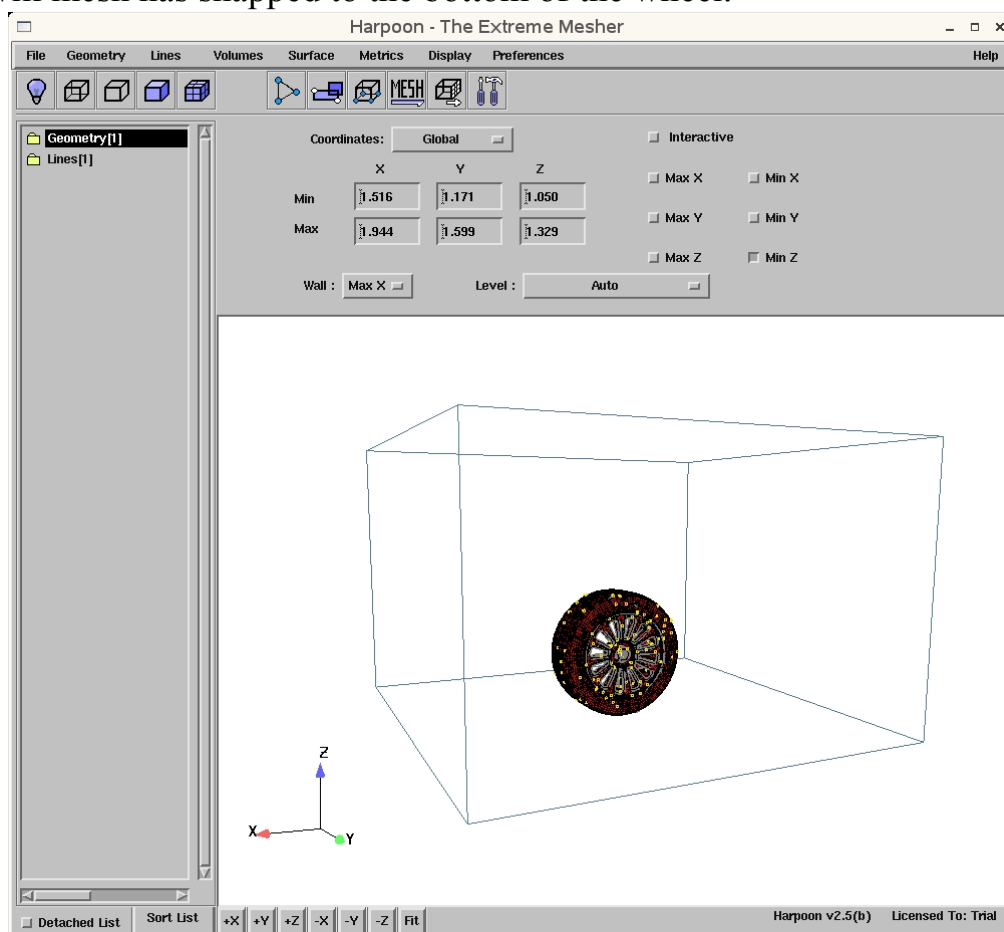
Coordinates: Global ☐ Interactive

	X	Y	Z
Min	1.516	1.171	1.050
Max	1.944	1.599	1.329

☐ Max X ☐ Min X
☐ Max Y ☐ Min Y
☐ Max Z ☒ Min Z

Wall: Max X Level: Auto

You will now see that the green box defining the domain that Harpoon will mesh has snapped to the bottom of the wheel.



Tip – to define your farfield you can input the values manually or use the interactive button to position it.

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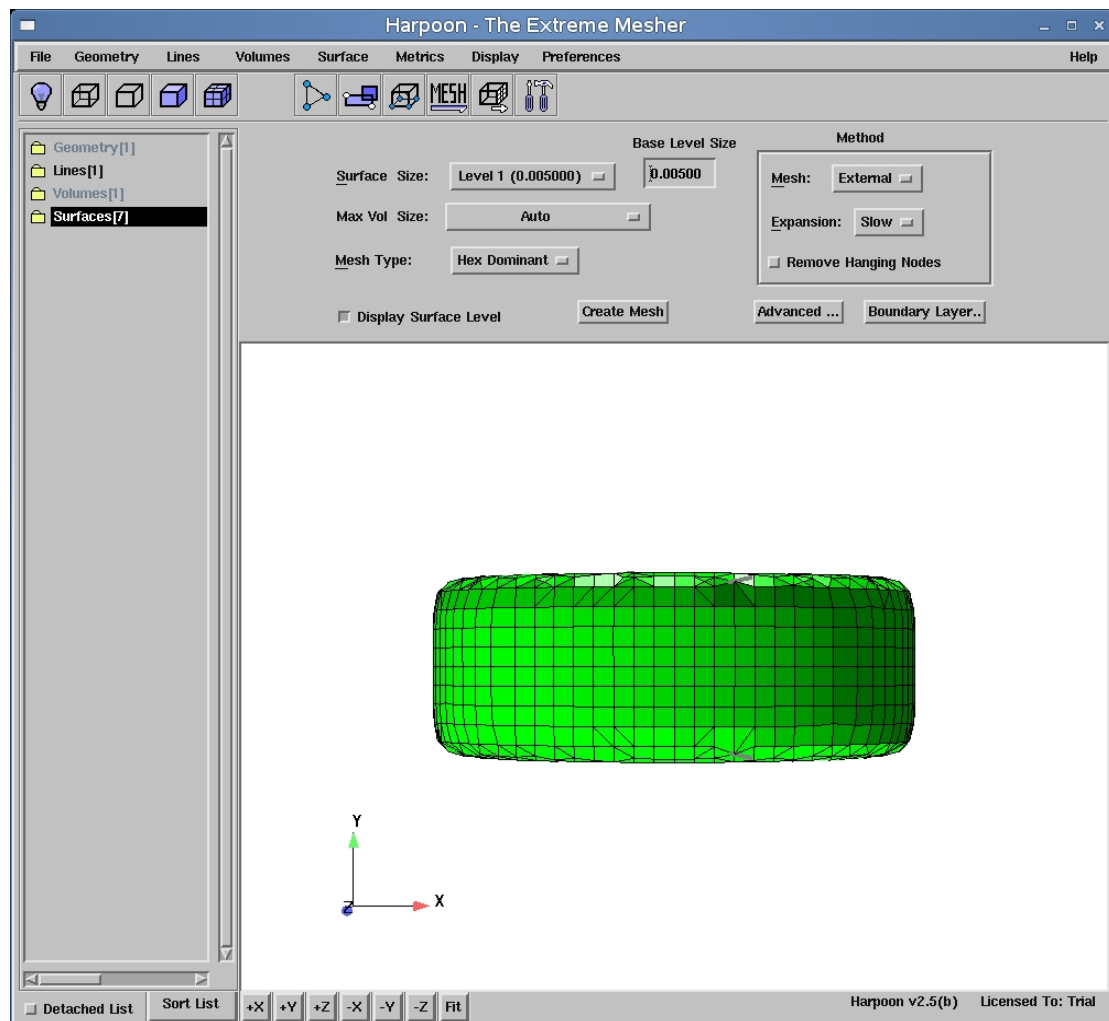
External Meshing

Creating a Mesh

10. Click **Create Mesh**

Create Mesh

Harpoon will rapidly mesh the geometry and the screen will update when meshing is complete.



Tip – You can check the status of Harpoon by looking at the shell/command window.

External Meshing

Inspecting the Mesh

11. Select the **Geometry** folder in the **Parts List**



12. Toggle the **Visibility** off



13. Select the **Surfaces** folder



14. Toggle **Hidden Line + Shaded**



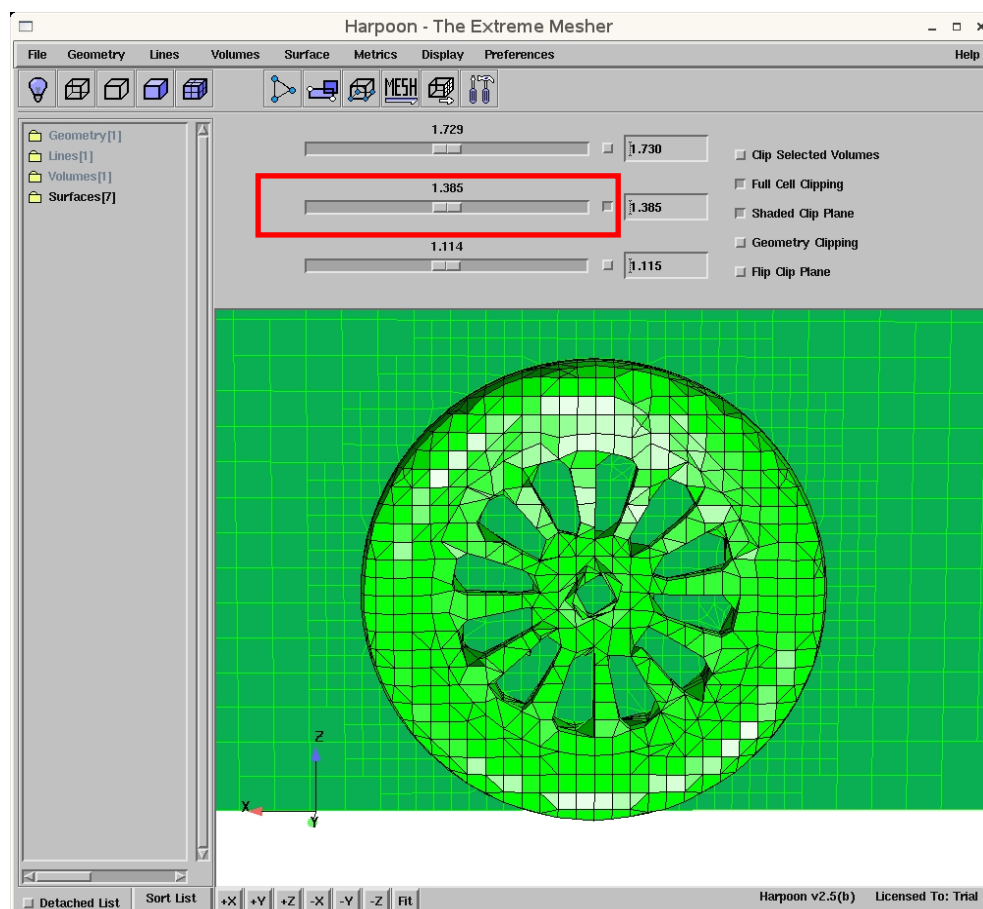
You can now inspect the surface mesh by rotating and zooming the geometry

15. Select the **Clip Geometry/Mesh** icon



16. Check the **Clip X Box**

17. Use the slider to inspect the volume mesh



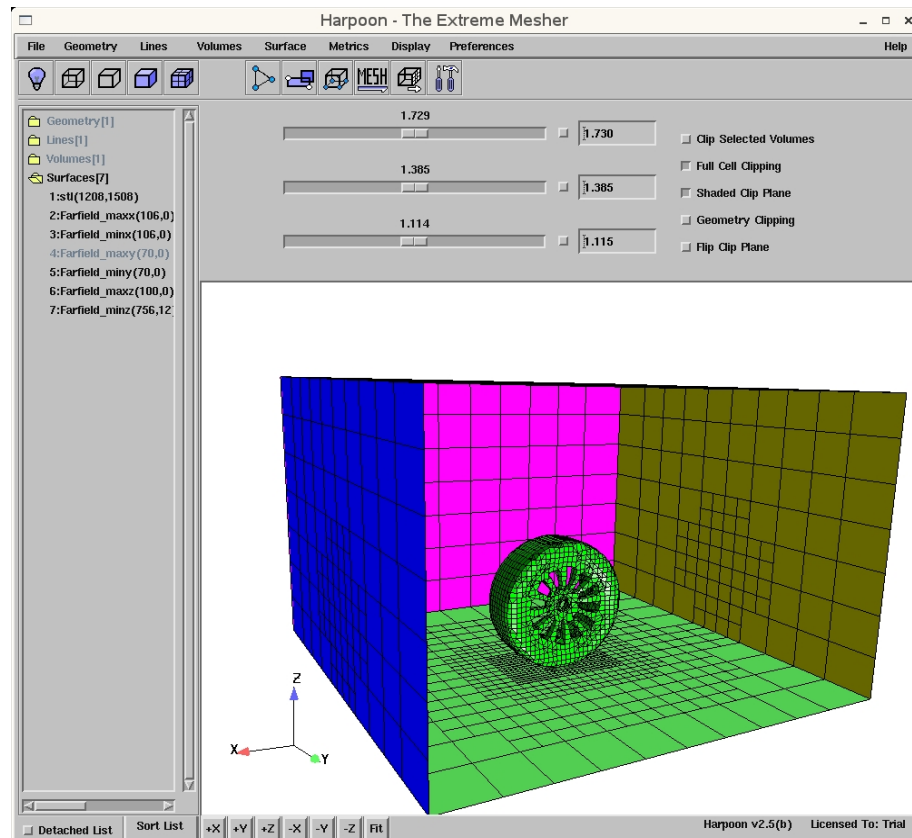
External Meshing

Export

The farwalls are contained within the surfaces folder

18. Double click the **Geometry** folder to expand the list

19. Turn the visibility of the walls on and off



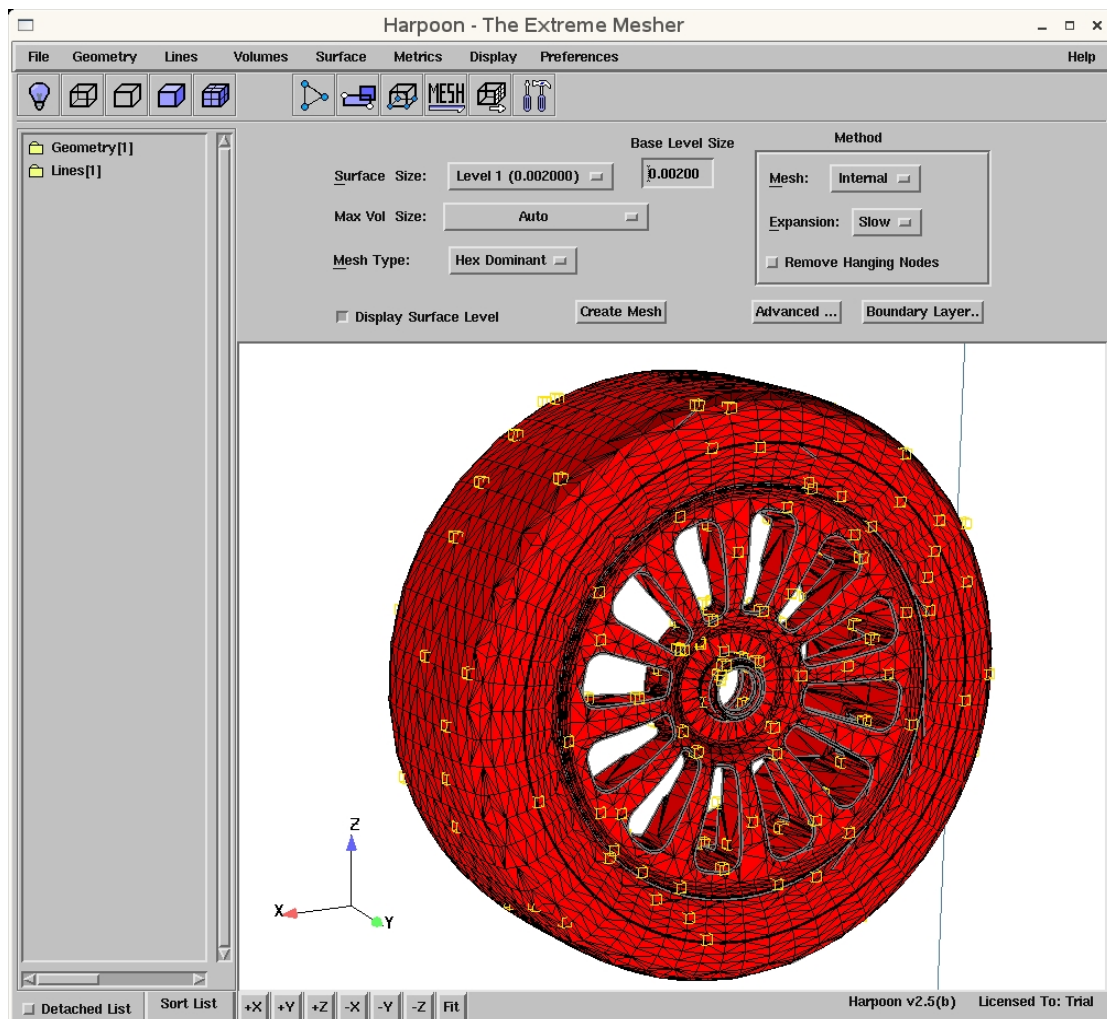
Select **File – Export** and export to your choice of solver

Tips

1. Try changing the **Base Level** to 0.01 and see how the mesh is affected.
2. Rename the parts using **Geometry – Rename Part**
3. Turn the visibility of the Lines in the parts list off

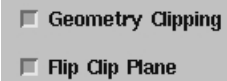
Internal Meshing

1. Import the **wheel.stl**
2. Pick a suitable **Base Level** (0.002)
3. Change the **Meshing Method** to **Internal**

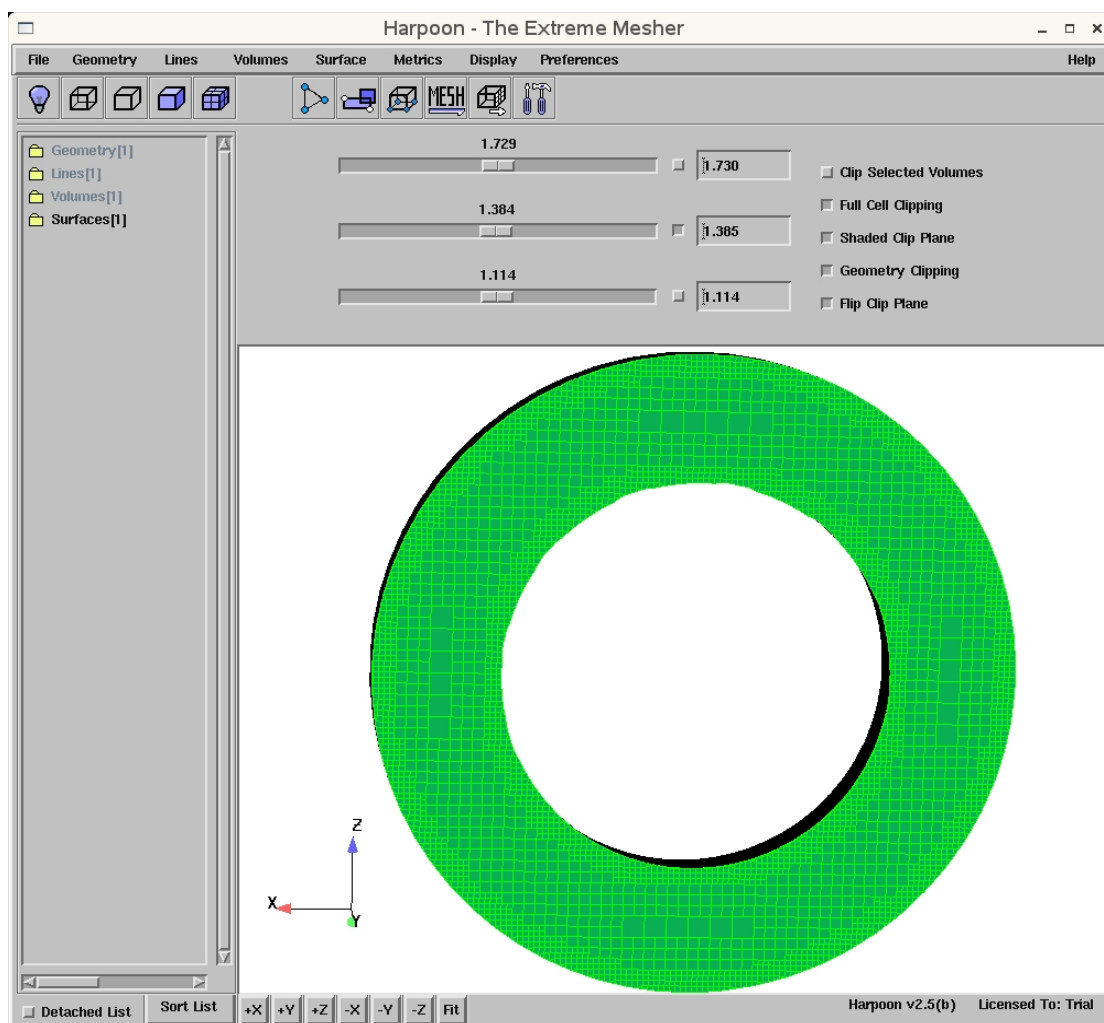


Internal Meshing

4. Hit **Create Mesh**
5. Select the **Clip Geometry/Mesh** icon
6. Check the **Clip X Box**
7. Toggle **Geometry Clipping** and **Flip Clip Plane**



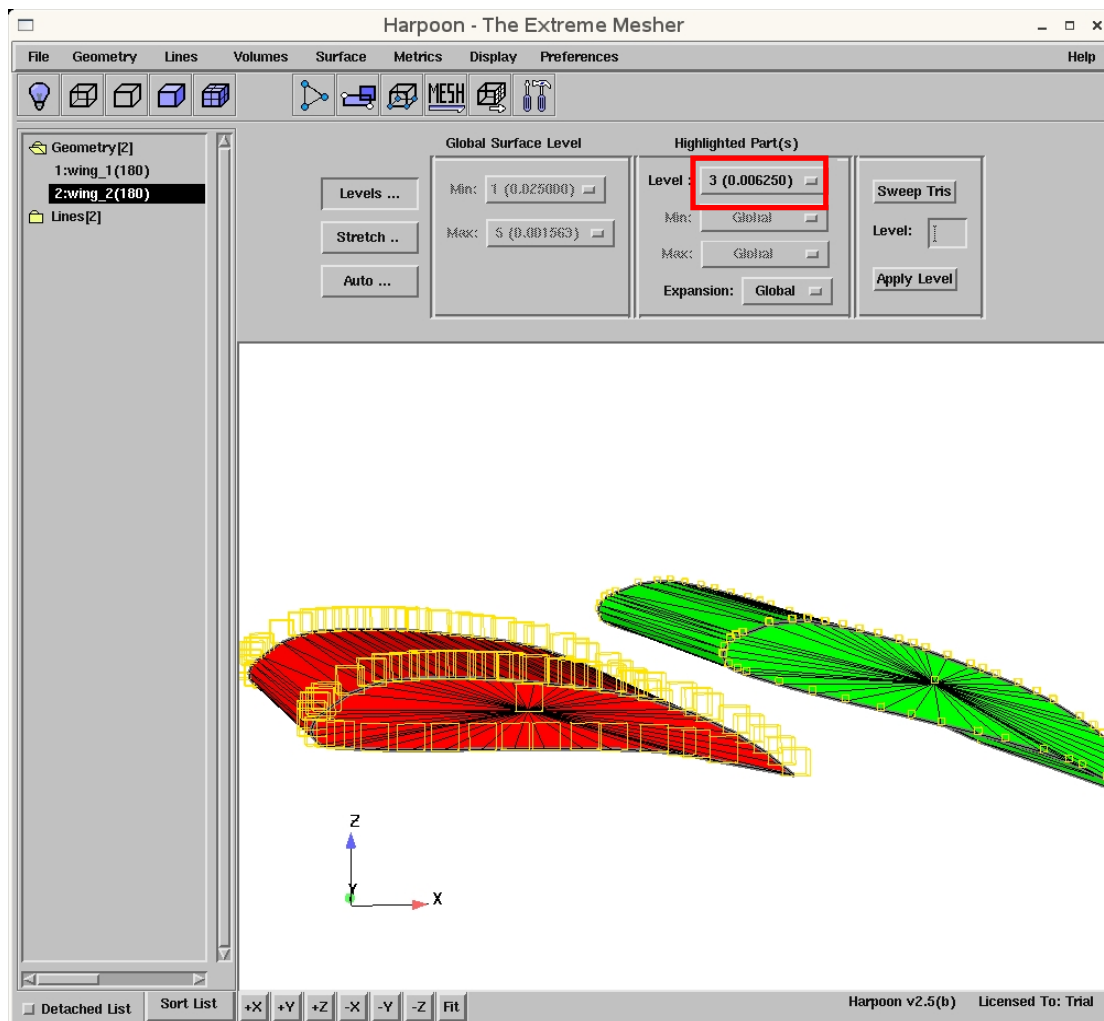
The resulting mesh should resemble the image below.



Tip – Harpoon can mesh External, Internal volumes or All

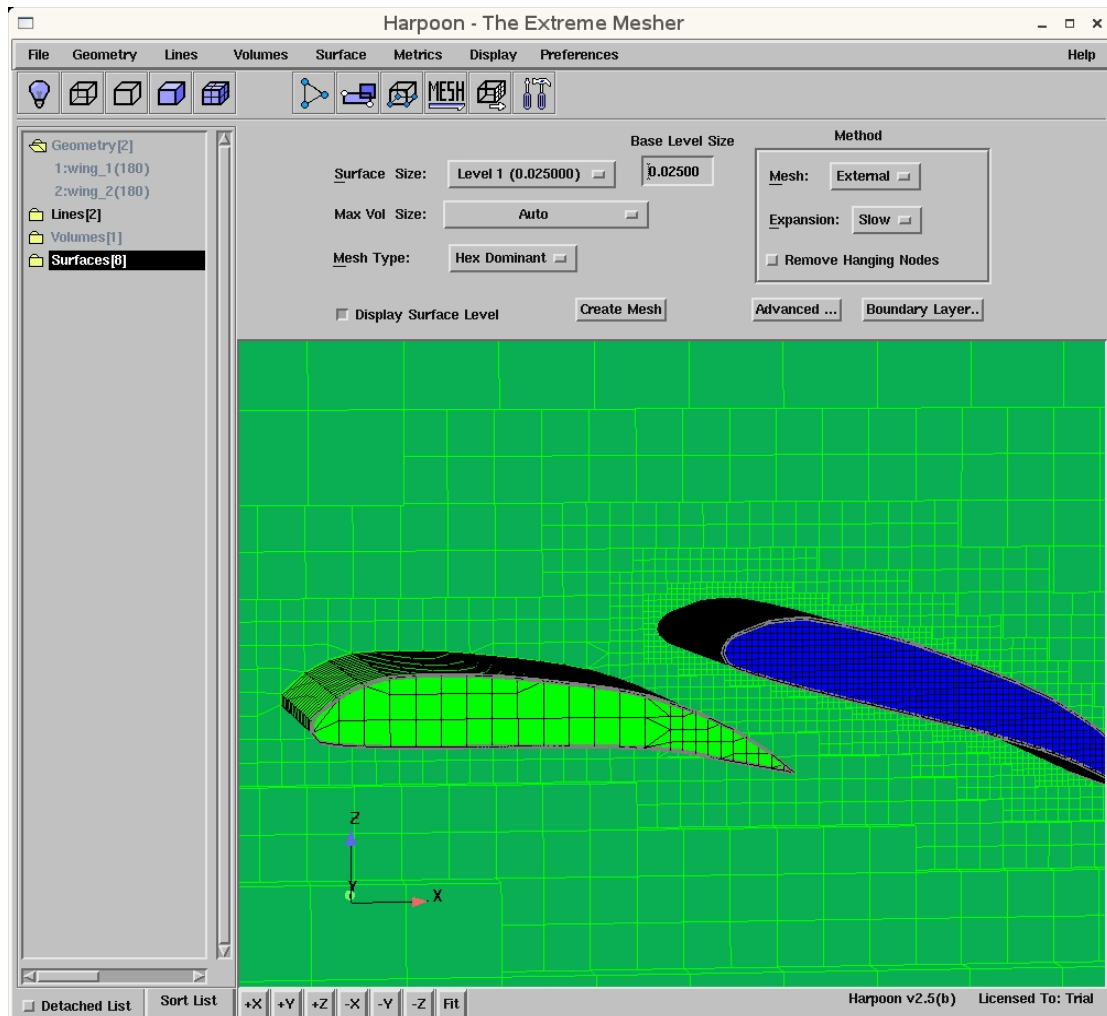
Multi Level Meshing

1. Import the file **wings.stl**
2. Change the **Base Level** to 0.025
3. Click on **Advanced** Advanced ...
4. Select **Part 2** in the **Parts List**
5. Set the **Highlighted Part(s)** level to 3



Multi Level Meshing

6. Hit **Create Mesh**
7. When Harpoon is finished clip the volume and shade the surfaces to view the expansion of the mesh




Tip – You can separate your geometry by region, feature or selection and assign appropriate levels to them.

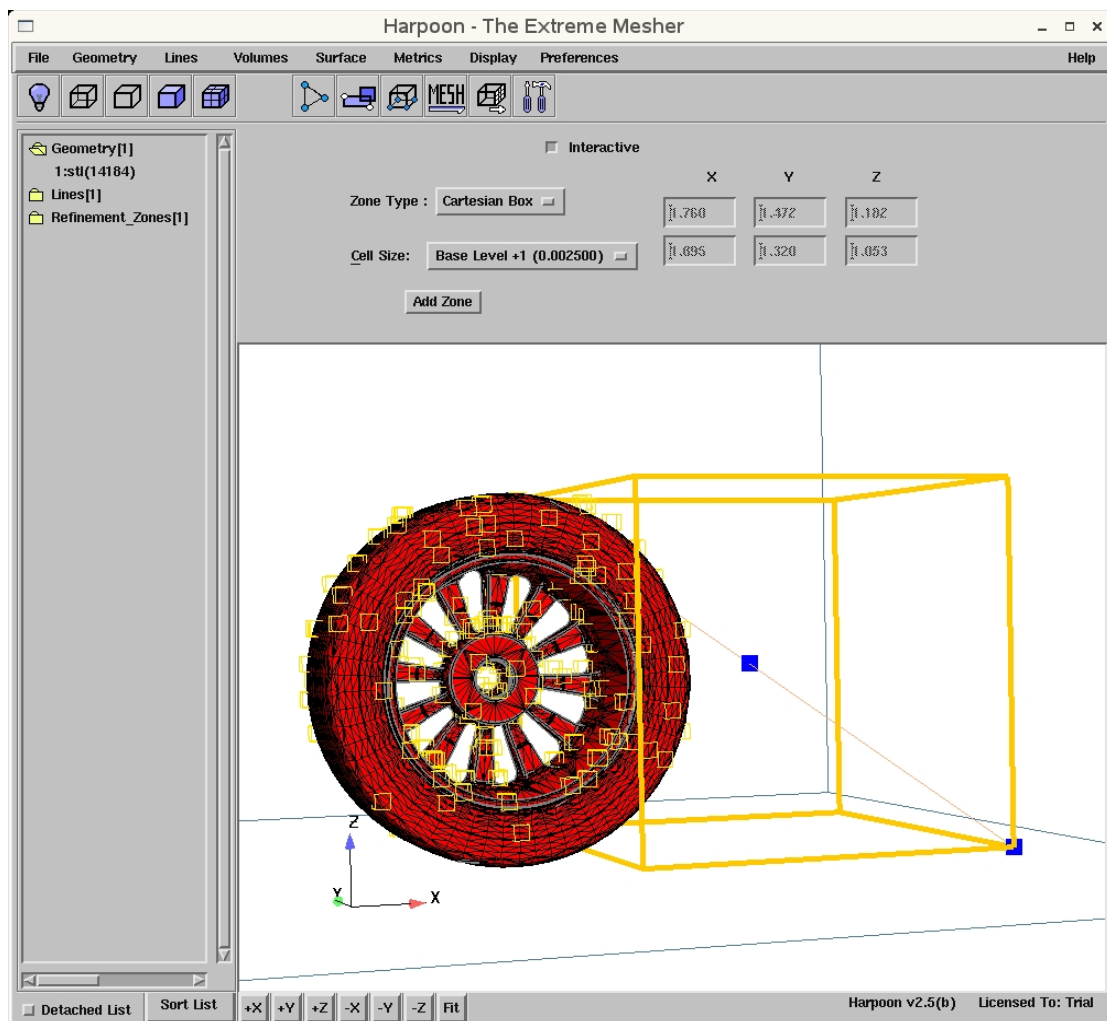
Tip – You can also assign levels to feature lines themselves.

Refining the Mesh

There will be times when you want to have control of the size of the cells in the volume of the mesh within areas of interest. To do this Harpoon uses refinement areas, which can be either a box, sphere or trapezoidal box with all corners moveable.

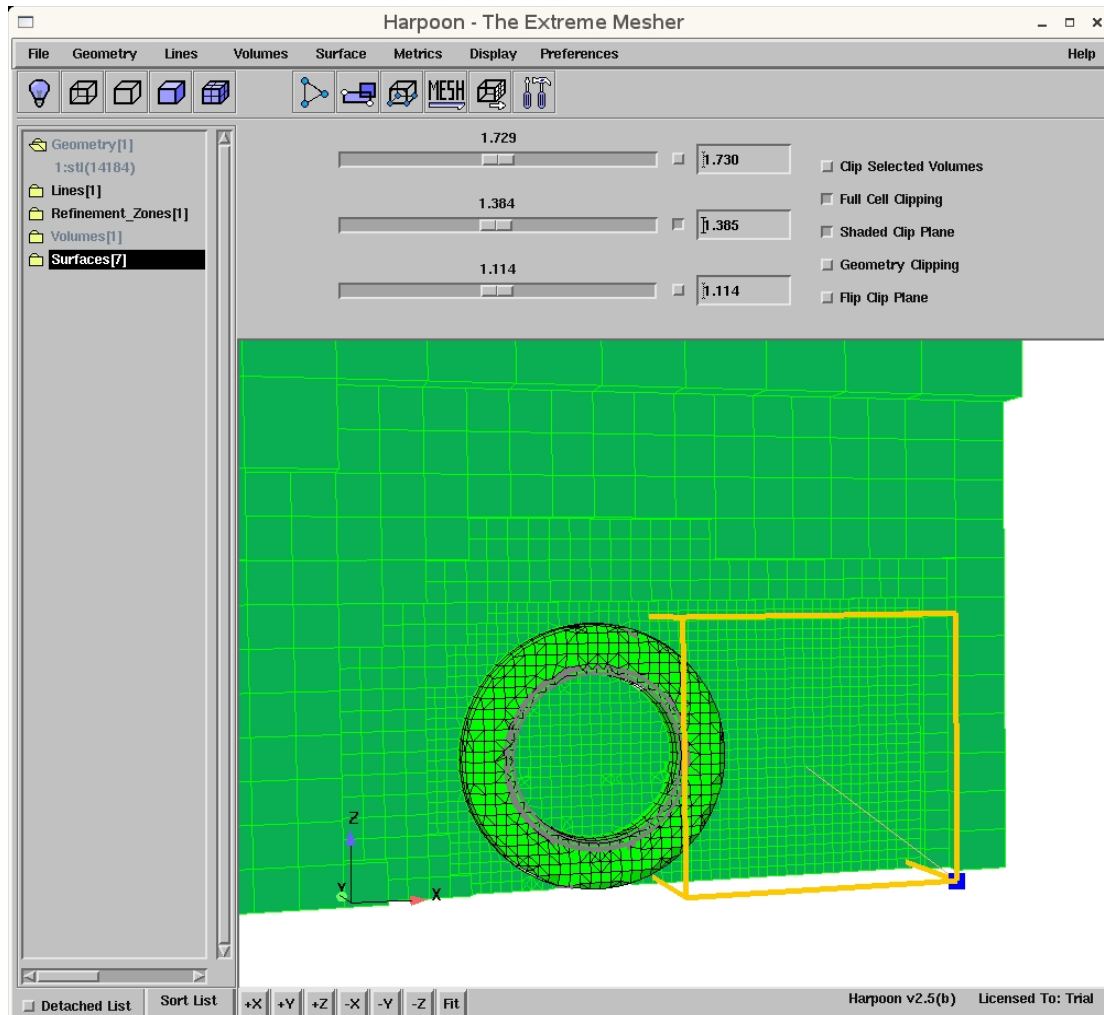
To add a refinement area to your model

1. Click on the Refinement Icon. 
2. Click Add Zone
3. Click on 3 points on the surface of the geometry
4. Check the Interactive Box
5. Move the Refinement Shape into position using the handles
6. Assign a different level size in the Refinement Process Area (level 2)



Refining the Mesh

8. Hit Create Mesh



The image above shows the mesh refinement in the region specified.

Tip – You must have the Refinement Zone selected in the parts list to apply any Level changes

Tip - Remember to turn off the Interactive toggle once the shape has been positioned.