



Altair

HyperWorks

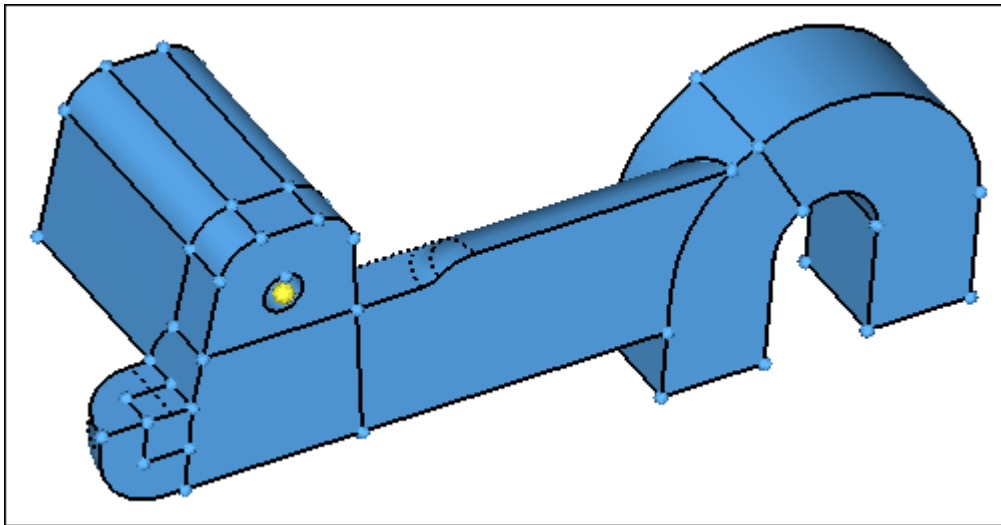
HM-3220: Creating a Hexahedral Mesh using the Solid Map Function

In this tutorial, you will learn how to create a hexahedral mesh using the Solid map function by one volume and multisolid method.

Solids are geometric entities that define a three-dimensional volume. The use of solid geometry is helpful when dividing a part into multiple volumes. For example, divide a part into simple, mappable regions to hex mesh the part. Use the **Solid Map** panel to create a mesh of solid elements in a solid geometric volume.

Model Files

This exercise uses the `solid_map.hm` file, which can be found in the `hm.zip` file. Copy the file(s) from this directory to your working directory.




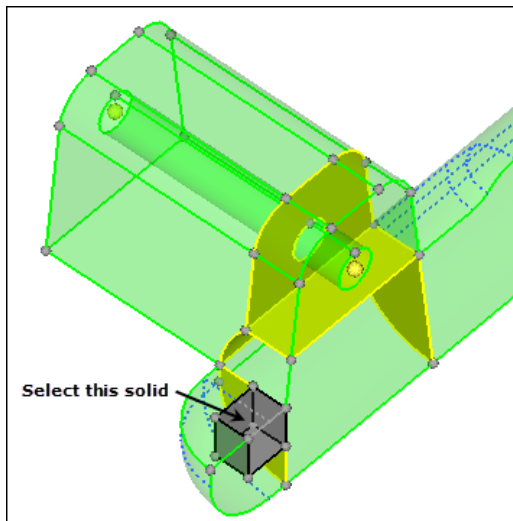
Exercise: Hex-meshing Solid Geometry


Step 1: Retrieve model file, `solid_map.hm`.

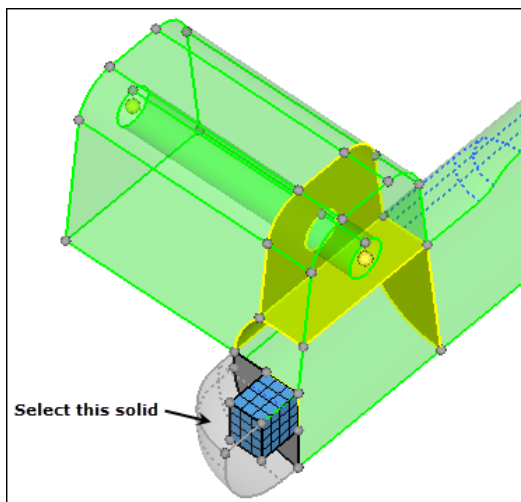
1. Start HyperMesh Desktop.
2. From the menu bar, click **File > Open > Model**.
3. In the **Open Model** dialog, open the `solid_map.hm` model file.

Step 2: Mesh the 1/8th sphere-shaped region.

1. Shade the model's geometry and surface edges by clicking  on the **Visualization** toolbar.
2. Open the **Solid Map Mesh** panel by clicking **Mesh > Create > Solid Map Mesh** from the menu bar.
3. Go to the **one volume** subpanel.
4. Under **along parameters**, enter 1 in the **elem size=** field.
5. Activate the **volume to mesh: solid** entity selector.
6. Select the small cube-shaped solid, as indicated in the following image.



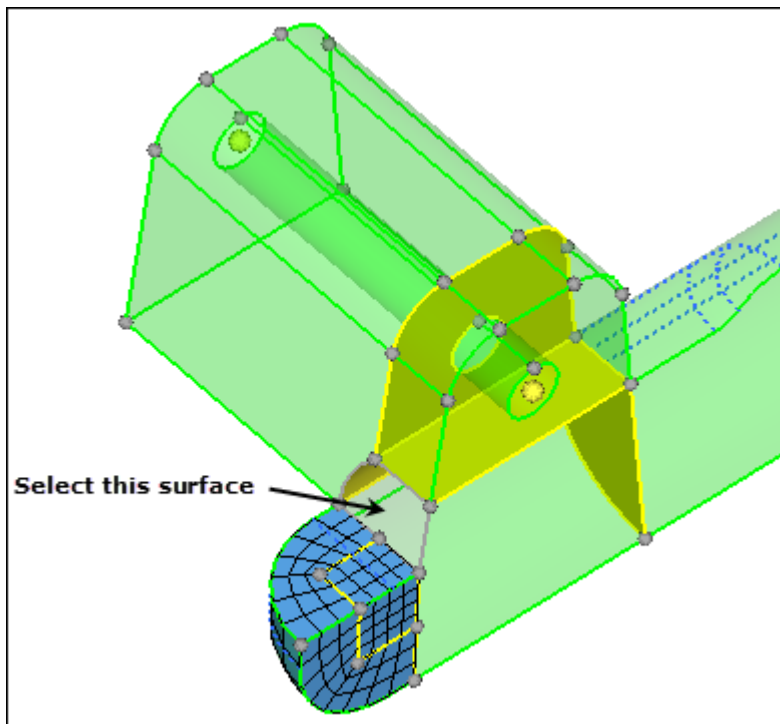
7. Click **mesh**.
8. Shade the model's elements and mesh lines by clicking  on the **Visualization** toolbar.
9. Select the solid as indicated in the following image.



10. Click **mesh**.
11. Return to the main menu by clicking **return**.

Step 3: Create a shell mesh with the Automesh panel to control a mesh pattern.

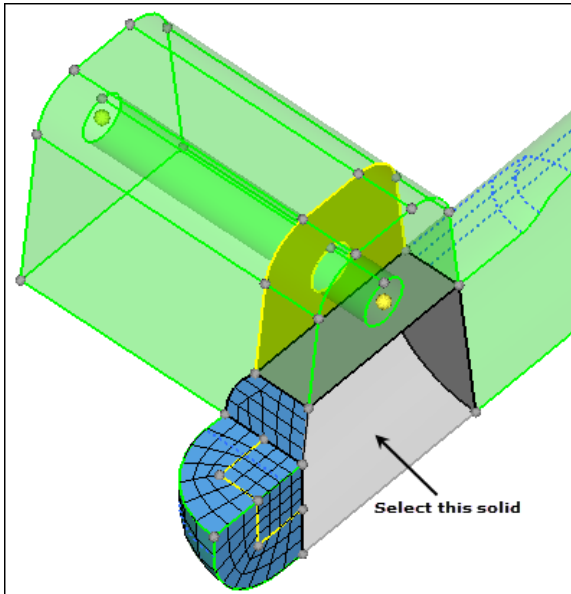
1. Open the **Automesh** panel by clicking **Mesh > Create > 2D AutoMesh** from the menu bar.
2. Go to the **size and bias** subpanel.
3. Select the surface as indicated in the following image.



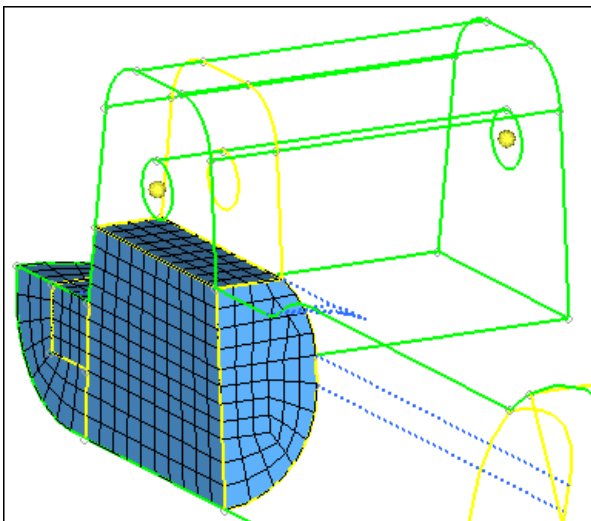
4. Set the meshing mode to **interactive**.
5. In the **element size =** field, enter 1.000.
6. Set the **mesh type** to **mixed**.
7. Click **mesh**. The meshing module opens.
8. Verify that you are in the **density** subpanel.
9. In the **elem density =** field, enter 4.
10. Click **set all to**. HyperMesh sets all the edge densities to 4.
11. Click **mesh**.
12. Return to the main menu by clicking **return** twice.

Step 4: Mesh the solid volume on which the surface mesh was created in Step 3.

1. Open the **Solid Map Mesh** panel.
2. Go to the **one volume** subpanel.
3. Select the volume shown in the following image.



4. Under **along parameters**, toggle **elem size=** to **density=**.
5. In the **density=** field, enter 10.
6. Click **mesh**.
7. Rotate the part and note how the mesh pattern created with the **Automesh** panel has been used for the solid elements.



Step 5: Mesh the remaining solid volumes.

In this step, you should still be in the **Solid Map Mesh** panel, **one volume** subpanel.

1. Select one of the remaining unmeshed solid volumes.
Note: Make sure to select a solid adjacent to one that has already been meshed so that connectivity is maintained.
2. Set the **source shells** to *mixed*.
3. Under **along parameters**, toggle *density=* to *elem size=*
4. In the **elem size=** field, enter 1.5.
5. Click *mesh*.
6. Repeat until all solid volumes are meshed.
7. Return to the main menu by clicking *return*.

Step 6 (Optional): Save your work.

With this section of the exercise completed, it is a good time to save the model.

1. From the menu bar, click **File > Save > Model**.

Automated Solid Map Meshing




The capability to automate the solid map meshing process is now available. Using the “**Mappable**” visualization mode in conjunction with the multi-solids feature will inform you that the solid(s) are ready for solid meshing. Using the multi-solids feature will allow for all solids within the model to be meshed in one step, provided that they are mappable.

In this section of the tutorial, you will delete all of the elements from the previous section. You will then use the Mappable visualization mode with multi-solids to solid mesh the part.

Step 7: Delete the elements within the model.

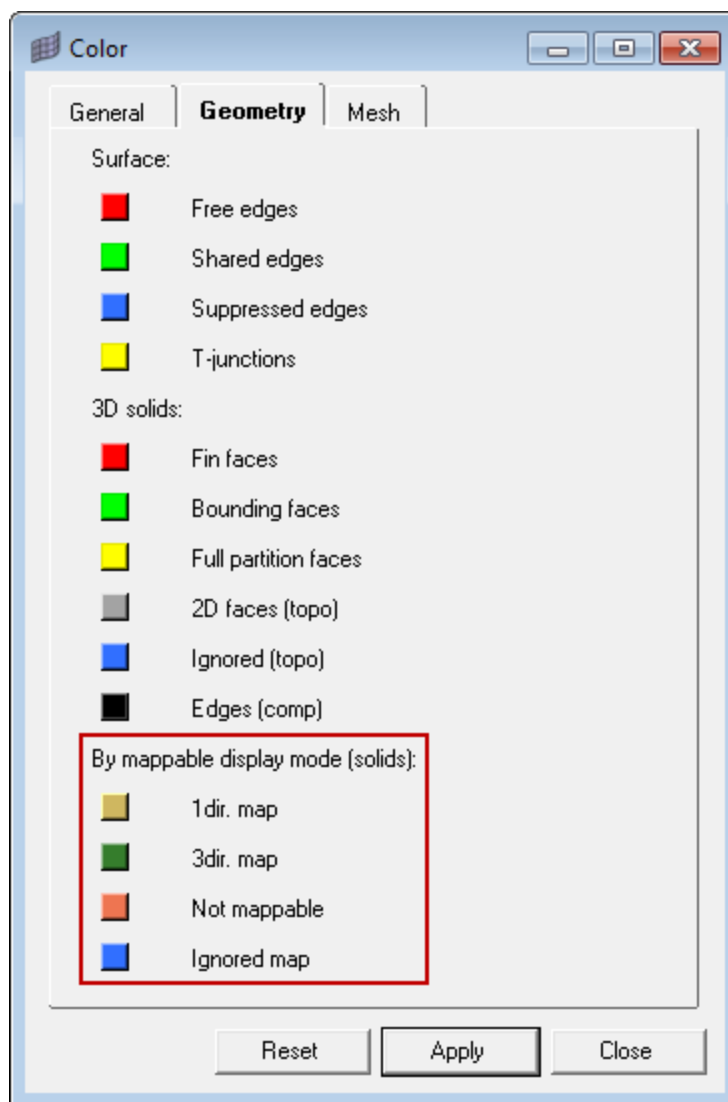
1. Open the **Delete** panel by pressing **F2**.
2. Click *elems >> all*.
3. Click *delete entity*.
4. Return to the main menu by clicking *return*.

Step 8: Use the mappable visualization mode.

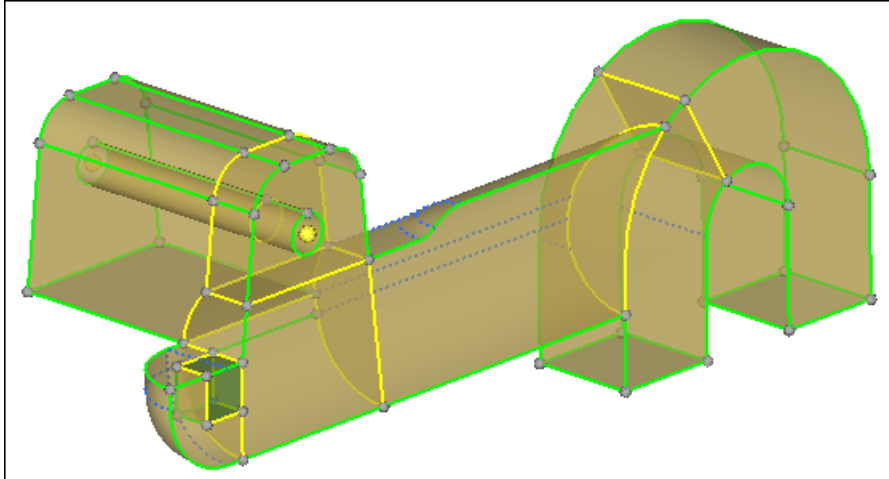
1. Shade the model's geometry and surface edges by clicking  on the **Visualization** toolbar.
2. From the **Geometry Visualization** list, select  Mappable . HyperMesh color codes each solid to represent its mappable state.

Note: The goal is to ensure that each solid is either 1-directional or 3-directional mappable.

3. From the menu bar, click **Preferences > Colors**.
4. In the **Color** dialog click the **Geometry** tab.
5. Optional: Under **By mappable display mode (solids)**, click the color swatches to adjust the display color of the following:
 - **1dir. map**: Visualization for solids that can be mapped, for 3D meshing, in one direction.
 - **3dir. map**: Visualization for solids that can be mapped, for 3D meshing, in three directions.
 - **ignored map**: Default visualization for solids that require partitioning to become mappable.
 - **not mappable**: Visualization for solids that have been edited, but still require further partitioning to create mappable solids.



Once in the mappable visualization mode, it is clear that there is one 3-directional mappable solid and the rest are 1-directional mappable.

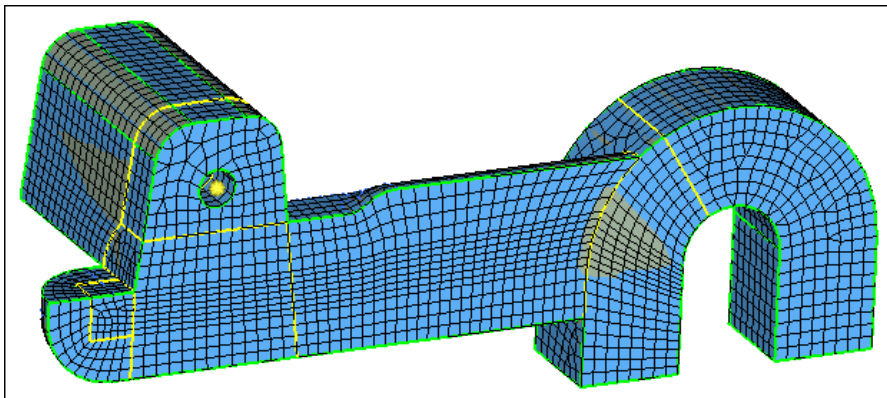


Step 9: Use the multi-solid feature to mesh the part.

1. Open the **Solid Map Mesh** panel.
2. Go to the **multi solids** subpanel.
3. Click **solids** >> **all**. HyperMesh selects all of the solids in the model.
4. Set the **source shells** to **mixed**.
5. In the **elem size** field, enter 1.
6. Click **mesh**. HyperMesh opens the interactive mesh mode.
7. Accept the shell elements and create solid elements by clicking **mesh**.

Note: The solids will be sequentially solid meshed.

8. Inspect the model and note that the mesh within all of the solids is correctly equivalenced.



9. Accept the solid element mesh and return to the **Solid Map Mesh** panel by clicking **return**.

Step 10 (Optional): Save your work.

With this exercise completed, you can save the model if desired.

1. From the menu bar, click **File > Save > Model**.