

# FLUENT - Turbulent Flow Past a Sphere - Step 2

UNDER CONSTRUCTION

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## Problem Specification

1. Create Geometry in GAMBIT
  2. Mesh Geometry in GAMBIT
  3. Specify Boundary Types in GAMBIT
  4. Set Up Problem in FLUENT
  5. Solve!
  6. Analyze Results
  7. Refine Mesh
- Problem 1

## Step 2: Mesh Geometry in GAMBIT

### Requirements for Hexahedral Volume Meshing

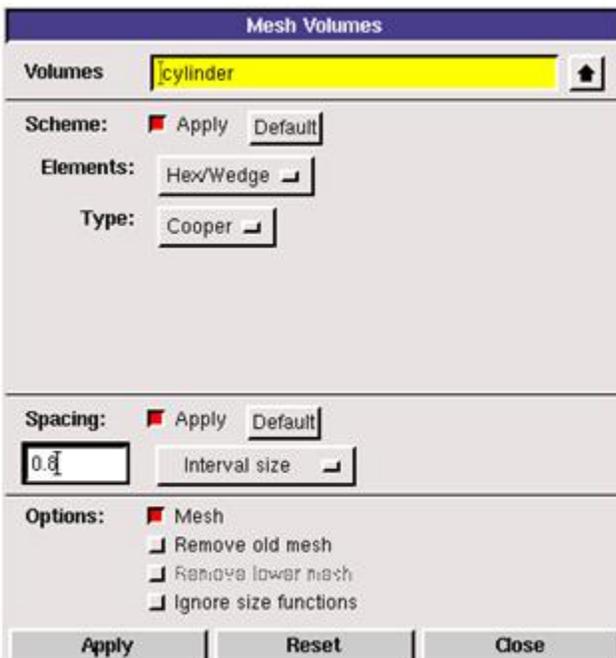
The hexahedral cell type is well suited for dealing with fluid flow that is moving perpendicular to the cell's alignment. However, the hexahedral cell is not as flexible as the more generalized tetrahedral cell in regards to the kinds of volumes it can be used with. The square profile of the hexahedral cell makes it very easy to use with empty, rectangular volumes like the segments you created in the flow domain. Irregular volumes or volumes containing some kind of blunt body or other object require additional effort. One of Gambit's options for dealing with such situations is called the Cooper Meshing Scheme. Basically, the Cooper Scheme functions by meshing one or more sources (faces with a profile that remains consistent as you move through the volume on a perpendicular line) and then 'sweeping' the source faces through the volume. The Cooper Scheme can mesh hexahedral cells around objects in a volume, provided the object is uniform and extends through the entire volume. The Cooper Scheme cannot handle the 3-dimensional curves of an entire sphere, but it can handle portions of it. Likewise, the Cooper Scheme cannot handle the small sphere box. For more information, look up volume mesh > Cooper scheme in the index of the Gambit User Guide.

### Meshing Around the Sphere

We're interested in fluid flow behavior near the sphere and the volumes comprising the sphere are the most unusual ones in our model, therefore we will start by first meshing the four volumes comprising the sphere to ensure best possible mesh alignment. Open the Mesh Command Window and go to Mesh Volumes.

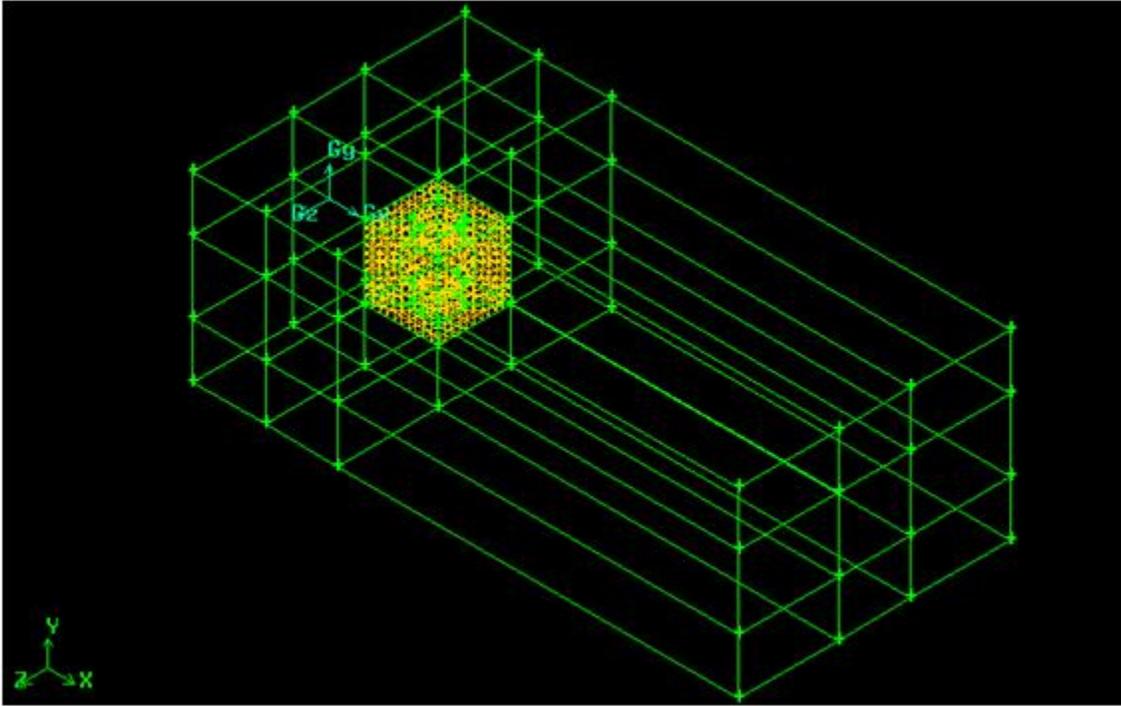
Operation Toolpad > Mesh Command Button  > Volume Command Button  > Mesh Volumes 

The two cylindrical pieces are the smallest so start with them. Select *cylinder* and *cap* either from the list of available volumes or by shift-clicking with your mouse. Notice that, when you select a volume, Gambit automatically changes the settings a recommended mesh elements and type based on its evaluation of the volume. Thanks to the volume segmenting, Gambit's recommendation is exactly what we want: Hex/Wedge elements and Cooper type. For spacing, which is how we'll be controlling mesh density, make spacing controlled by interval size and set the interval size to 0.8.



The same spacing controls and interval size will be used for the entire model, producing a uniform mesh.

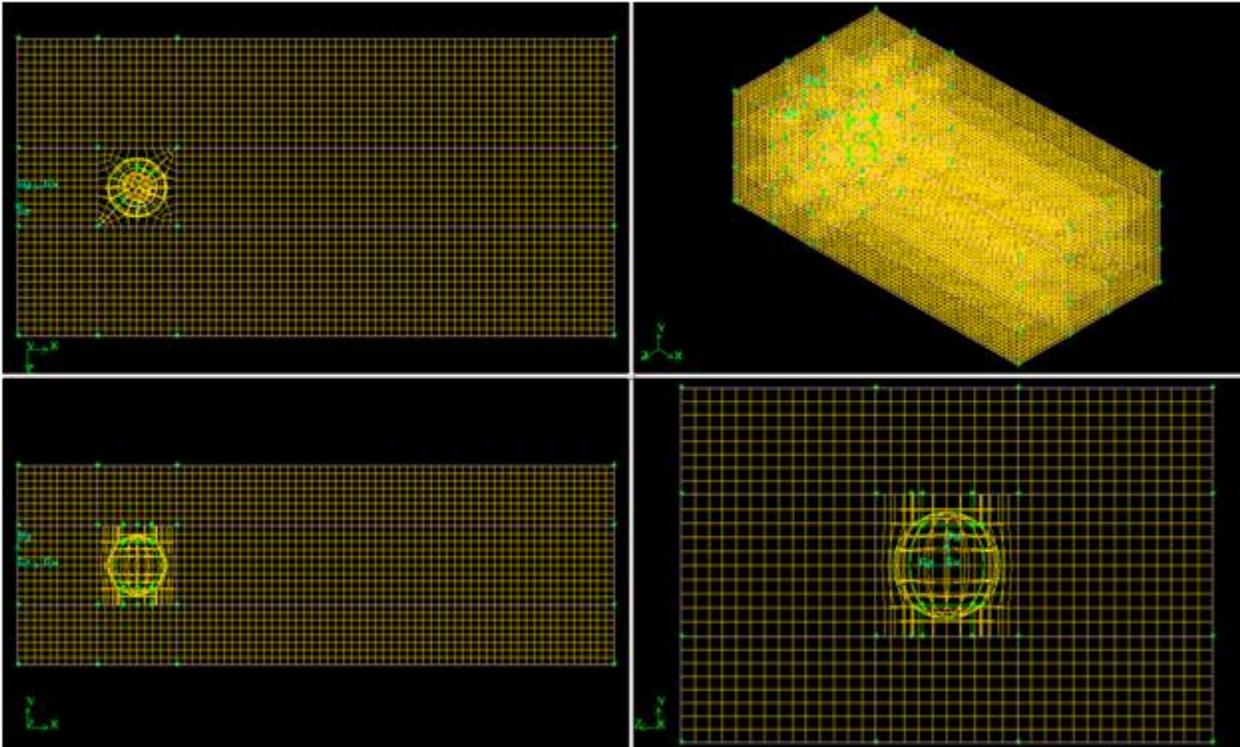
After meshing *cylinder* and *cap*, select *sphere\_box* and *diag\_box*. Gambit will again recommend Hex/Wedge with Cooper. Set the interval size to 0.8 and mesh these two volumes.



### Meshing the Surrounding Flow Domain

Because the volumes composing the sphere were meshed first, the surrounding volumes will be meshed relative to the sphere's volumes. Surrounding the sphere box with large, empty rectangles will allow for use of hexahedral cells but this alone does not guarantee a properly aligned mesh. The number of cells on any shared face need to be the same for any two adjacent volumes and Gambit will automatically adjust the mesh alignment of one volume to match another volume. If a rectangle as long as the flow domain was placed above the sphere box and meshed, the resulting mesh would be seriously skewed. In other words, the segmenting of the flow domain volume is necessary for an aligned and uniform mesh.

In the Mesh Volumes command window, open the list of available volumes and select all listed volumes except *cylinder*, *cap*, *sphere\_box*, and *diag\_box*. This time you may have to set the mesh options yourself. For "Elements" select "Hex/Wedge" and the only option for "Type" will be "Cooper." Check "Apply" to enable spacing controls and use interval size 0.8 to mesh these volumes.



You should have a mesh structure that resembles the four points of view displayed above.

Go to [Step 3. Specify Boundary Types in Gambit](#)

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