

FLUENT - Steady Flow Past a Cylinder - Step 1

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
Problem 2



Video Tutorials Available

If you are having trouble following written tutorial, detailed video tutorials are available [here](#)

Step 1: Create Geometry in GAMBIT



If you would prefer to skip the mesh generation steps, you can download the mesh from [here](#) and go straight to step 4.

In an external flow such as the flow past a cylinder, we have to define farfield boundaries and mesh the region between the cylinder geometry and the boundaries. Farfield boundaries should be placed well away from the cylinder such that the boundary conditions will not affect the flow near cylinder.

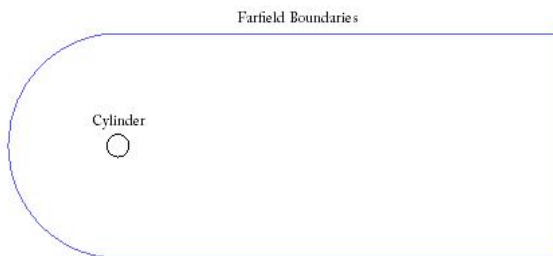
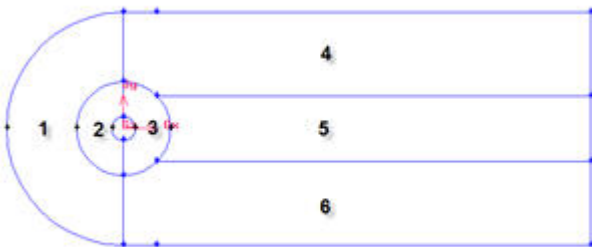


Figure above shows the geometry of such a case.

Strategy for Creating Geometry

To model this flow, we need a cylinder and farfield boundaries. We need finer meshes around the cylinder to capture the active region (call this radius of influence). Downstream of the flow, there will be wake generated by the cylinder, which requires finer mesh to better capture this phenomena. To be able to specify such regions, we split the domain into different faces as shown below.



We set the geometry upstream to be shorter because we have less activity before flow through cylinder. We set the geometry downstream of the cylinder to be relatively longer such that the boundary conditions will not affect the flow near cylinder.

Create a Working Directory

Create a folder called *cylinder* in a convenient location. We'll use this as the working folder in which files created during the session will be stored.

Start GAMBIT

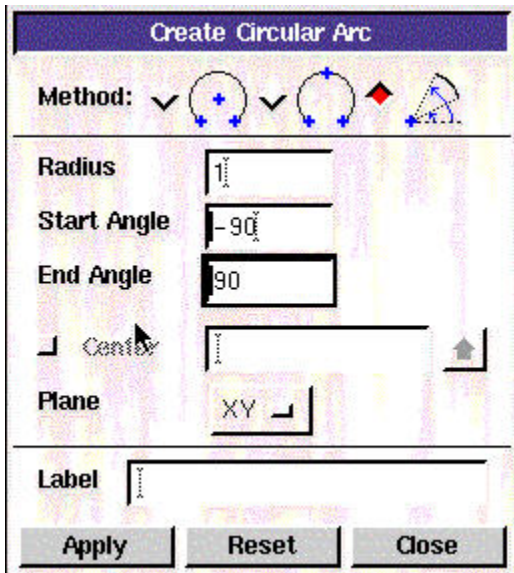
Create a new directory called *cylinder* and start *GAMBIT* from that directory by typing `gambit -id cylinder` at the command prompt.

Under **Main Menu**, select **Solver > FLUENT 5/6** since the mesh to be created is to be used in FLUENT 6.0.

Create Cylinder

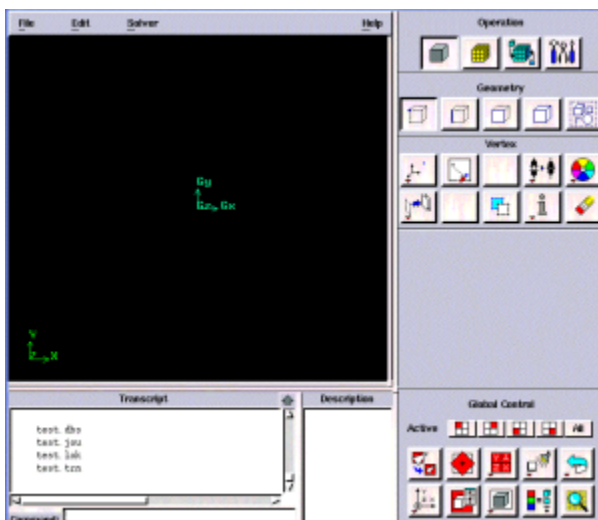
Create the cylinder using two arcs. The cylinder is created with two arc because they are going to be meshed differently. Back arc spans from -90 to 90 deg. Front arc spans from 90 to -90 deg. Both arc with radius 1.

Operation Toolpad > Geometry Command Button  > Edge Command Button  > Create Edge  > Arc  > 



Next to **Radius**, enter 1. Next to **Start Angle**, enter -90. Next to **End Angle**, enter 90. Click **Apply**. Do the same for front arc but enter different value for angles.

⚠ Always make arc in counterclock wise direction



(Click here for animated steps)


 Right mouse click on Create Edge icon to see more options.

Create Front Outer Boundary

We will create the outer boundary by creating arc 10 times of the cylinder front arc. We can use copy edges and scale by 10 to create the outer boundary.

Operation Toolpad > Geometry Command Button  > Edge Command Button  > Move/Copy Edges 


Move / Copy Edges


Edges 

☒ Move ☒ Copy

Operation:
☒ Translate ☒ Rotate
☒ Reflect ☒ Scale

Factor

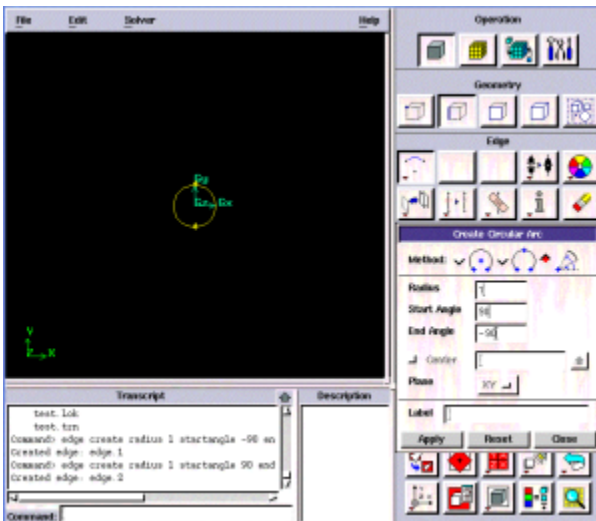
Coordinate Sys. 

Type 


| Global | | Local | |
|--------|--------------------------------|-------|--------------------------------|
| x: | <input type="text" value="0"/> | x: | <input type="text" value="0"/> |
| y: | <input type="text" value="0"/> | y: | <input type="text" value="0"/> |
| z: | <input type="text" value="0"/> | z: | <input type="text" value="0"/> |

☐ Copy mesh linked
☐ Copy mesh unlinked
☐ Copy zone types

Select the front cylinder edge. Make sure that the **Copy** is checked. Under **Operation**, select **Scale**. Next to **Factor**, enter a value of 10. This means that the radius of influence we create will be 10 times the size of the cylinder. Click **Apply**.



(Click here for animated steps)

 Do you know you can also press "Ctrl" + double left click to fit graphic in windows?

Create Back Outer Boundary

For this part, we will start with bottom up approach where we first create vertices and then using the vertices to create edges. Create the following vertices.

| Vertices | X | Y |
|----------|----|-----|
| 1 | 40 | 10 |
| 2 | 40 | -10 |

Operation Toolpad > Geometry Command Button  > Vertex Command Button  > Create Vertex 

Create the vertices by entering the coordinates under *Global*.

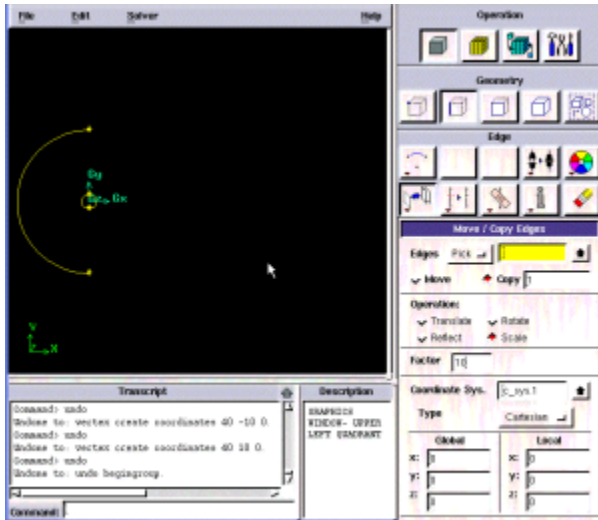
Click the *FIT TO WINDOW* button to scale the display so that you can see all the vertices.

Connect the vertices to create three edges

Operation Toolpad > Geometry Command Button  > Edge Command Button  > Create Edge 

 "shift" + left click and drag to select

Following animated steps show another method in creating vertices.



i "ctrl" + right click on the grid to create a vertex

✓ Do You Know?

Do you know that by clicking and holding right mouse click and move up and down, you can zoom in and out in the graphic window?
Do you know that by clicking middle mouse button, you can move object in graphic window?

Create Radius of Influence

Now we can proceed to create the geometry for radius of influence. Since both the cylinder and radius of influence is of same shape.

Create arc of radius 4 from -45 to 45 deg. Then create another arc from 45 to 45 deg.

Operation Toolpad > Geometry Command Button  > Edge Command Button  > Create Edge  > Arc  > 

Finally split the edge at 90 and -90 deg.

Operation Toolpad > Geometry Command Button  > Edge Command Button  > Split Edge 

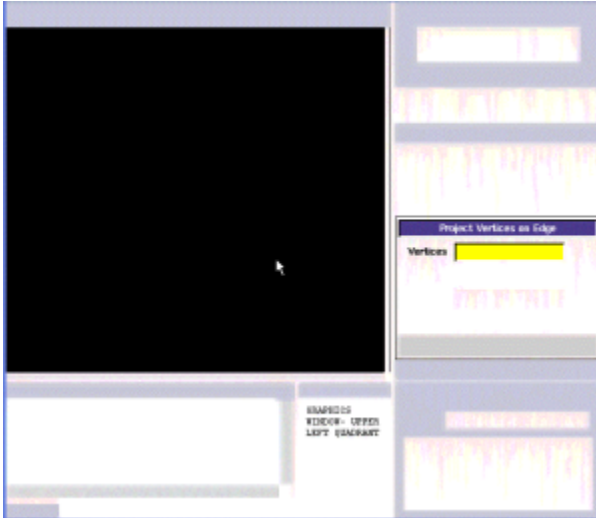
Remember to change the coordinate **Type** to *Cylindrical*.

Split Edge at Outer Boundary

For regular mesh, each edge has its opposite edge. Because of this, we can use projection method on the outer boundary to create the edge associated with the Radius of Influence edges.

Operation Toolpad > Geometry Command Button  > Vertex Command Button  > Project Button 

Select the vertex and associated edge. Make sure to select **Split edge**. At the end of this, you should have 4 new vertices.

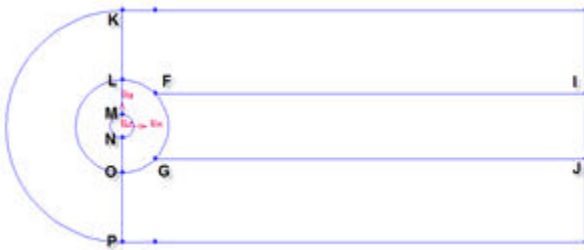


(Animated steps)

Connect all Vertices

Finally, connect all the remaining vertices **KL, LM, NO, OP, FI** and **GJ**.

The current geometry in Gambit should look like this:



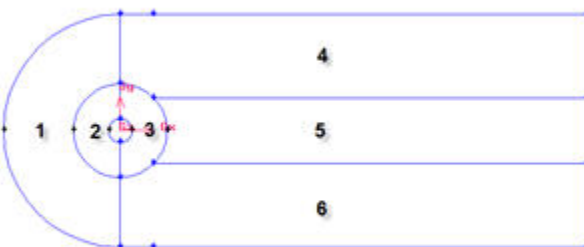
Create Faces

We can now join all the edges to form faces.

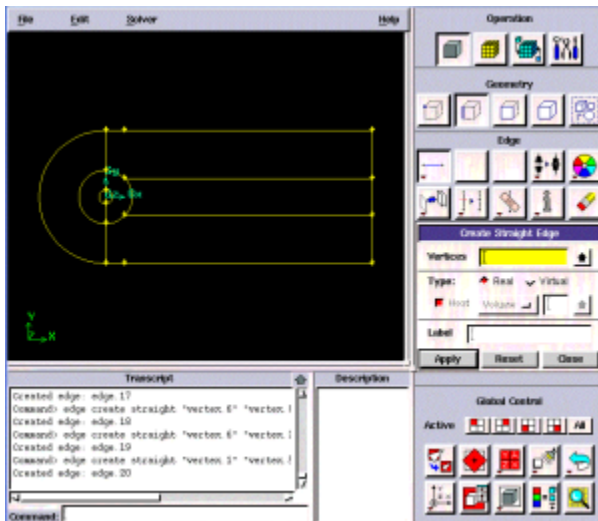
Operation Toolpad > Geometry Command Button  > Face Command Button  > Form Face 

This brings up the **Create Face From Wireframe** menu. Recall that we had selected vertices in order to create edges. Similarly, we will select edges in order to form a face.

There will be total of six faces.



Create all the six faces by connecting appropriate edges.



Animated steps

We are now ready to mesh the geometry.

[Go to Step 2: Mesh Geometry in GAMBIT](#)

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