

6. SEDAN GEOMETRY—TOLERANT IMPORT

In this tutorial you will import an IGES file containing the geometry for a sedan automobile, clean up the geometry, and mesh it with triangles and tetrahedra.

In this tutorial you will learn how to:

- Import an IGES file using “tolerant modeling”
- Specify the way in which the geometry will be colored
- Merge faces to facilitate meshing
- Apply size functions to control mesh quality
- Mesh a volume with a tetrahedral mesh
- Prepare the mesh to be read into FLUENT 5/6

6.1 Prerequisites

This tutorial assumes that you are familiar with the GAMBIT GUI. You should also familiarize yourself with the previous tutorial, which employs GAMBIT virtual clean-up operations for importing the sedan geometry.

6.2 Problem Description

Figure 6-1 shows the sedan geometry used in this tutorial. The external body of the sedan is represented by a set of connected faces. To model the flow around the sedan body, you will create a brick volume that represents the flow domain.

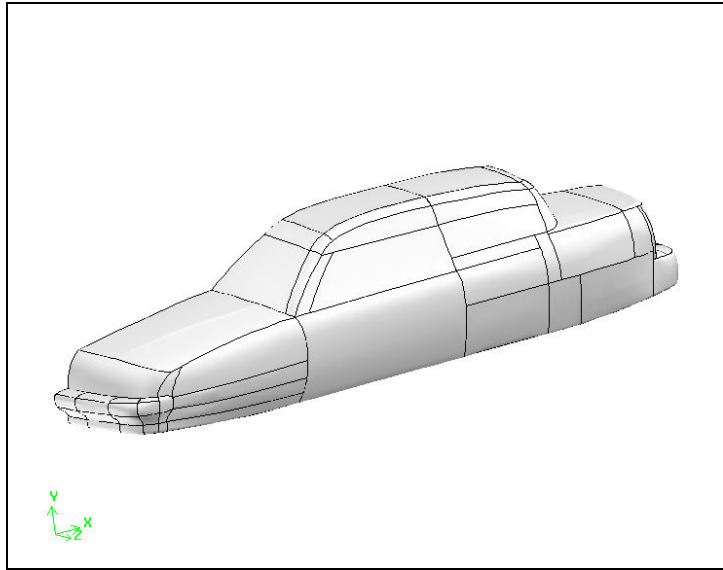


Figure 6-1: Sedan geometry

6.3 Strategy

In this tutorial, you will create a fully unstructured tetrahedral mesh around a car-body geometry imported as an IGES file. This tutorial illustrates the steps you would typically follow to prepare an imported CAD geometry for meshing. The IGES-file contains “dirty” geometry—that is, gaps exist between some of the surfaces that make it unsuitable for creating a CFD mesh. You will clean up the geometry using the GAMBIT “tolerant modeling” capability. The tolerant modeling option automatically assigns a tolerance value to each imported vertex and edge to maintain topological integrity for the imported model. The original CAD geometry is not modified during the import process.

The imported geometry includes a number of small surfaces, the edges of which may unnecessarily constrain the mesh generation process. Using the “merge faces” command, GAMBIT allows you to easily combine these surfaces prior to meshing. You can then have GAMBIT automatically create a triangular mesh on the car body.

Since the imported geometry consists only of the car body, you need to create a suitable domain around the car in order to conduct a CFD analysis (this is loosely equivalent to placing the car in a wind tunnel). The remainder of the tutorial shows how to add a real box around the car body, use virtual geometry to create some missing faces, and finally stitch all faces together into a single volume. This volume can then be meshed (without any decomposition) using a tetrahedral meshing scheme.

6.4 Procedure

1. Copy the file

`path/Fluent.Inc/gambit2.x/help/tutfiles/sedan.igs`

(where `2.x` is the GAMBIT version number) from the GAMBIT installation area in the directory `path` to your working directory.

2. Start GAMBIT.

Step 1: Select a Solver

1. Choose the solver from the main menu bar:

Solver → FLUENT 5/6

*The choice of a solver dictates the options available in various forms (for example, the boundary types available in the **Specify Boundary Types** form). For some systems, **Fluent 5/6** is the default solver. The solver currently selected is shown at the top of the GAMBIT GUI.*

Step 2: Import the IGES File

File → Import → IGES ...

This command sequence opens the Import IGES File form.

Import IGES File

File Name: **Browse...**

Summary:

Product ID	SEDAN		
System ID	ICEM SYSTEMS - ICEM IGES		
Model Space Scale	1	Units	MM
Date	971016	Time	201653
Distance Tolerance	0.0001		
Maximum Coordinate	1000000		

Import Options:

Translator: Native Spatial

Model Scale Factor

Stand-alone Geometry:

No stand-alone vertices

No stand-alone edges

No stand-alone faces

Import Source

Heal Geometry

Make Tolerant

Virtual Cleanup:

Connect Tolerance

Value

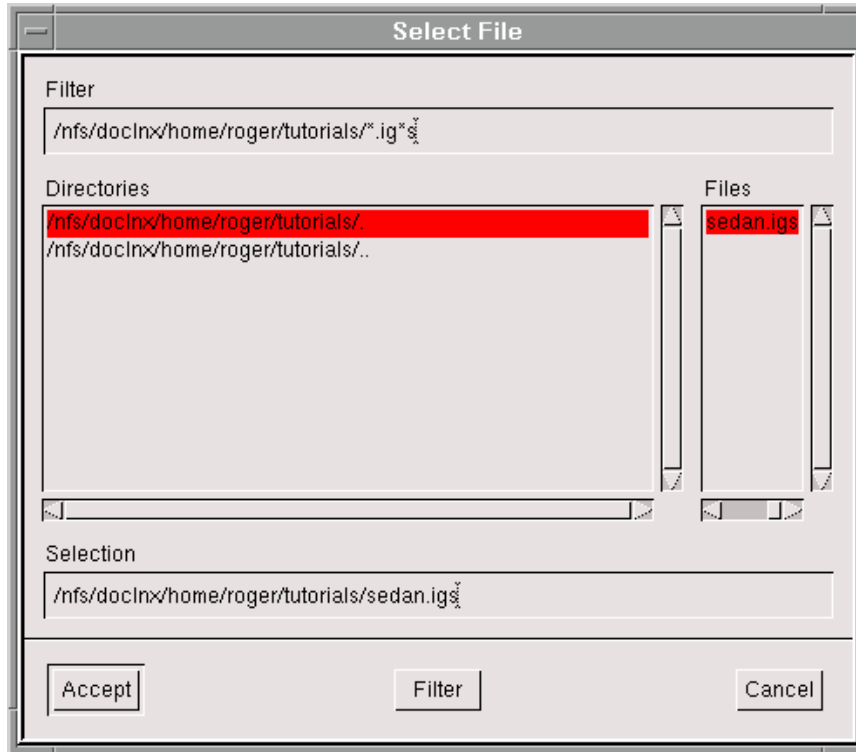
Shortest Edge %

Merge Tolerance

Accept **Reset** **Close**

1. Click on the **Browse...** button.

*This action opens the **Select File** form.*



- a) Select `sedan.igs` in the **Files** list.
 - b) Click **Accept** in the **Select File** form.
2. On the **Import IGES File** form, retain the **Make Tolerant** option.

*The **Make Tolerant** option sets individual tolerances for edges and vertices so that entities that are not connected to within normal GAMBIT default tolerances are treated as connected entities.*

3. Click **Accept**.

The IGES file for the sedan body will be read into GAMBIT as real geometry (see Figure 6-2).

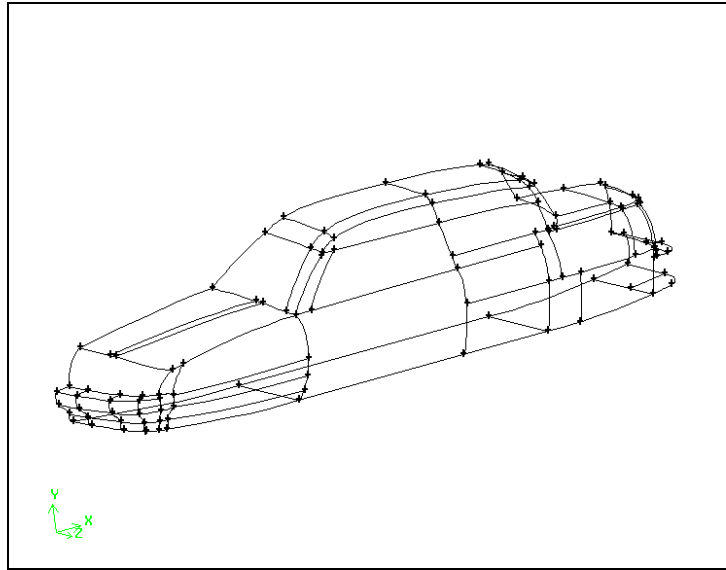




Figure 6-2: Imported sedan body

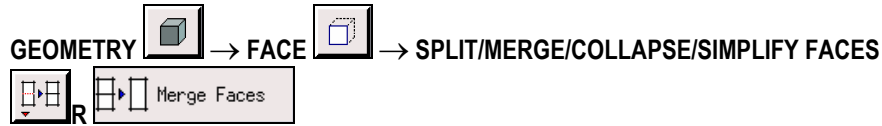
4. Click the **SPECIFY COLOR MODE** command button  in the **Global Control** toolpad to change the graphics display to connectivity-based coloring.

*The **SPECIFY COLOR MODE** command button will change to . When GAMBIT is in the connectivity display mode, the model is displayed with colors based on connectivity between entities rather than based on entity types. In this case, the colors of all edges in the graphics window are blue, indicating that the faces are connected to each other.*

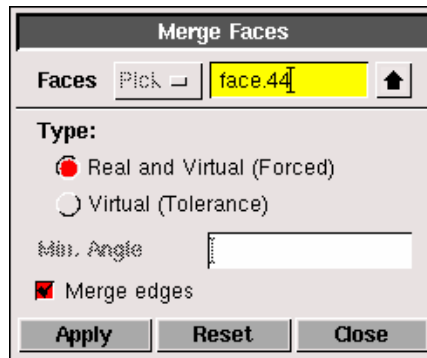
Step 3: Merge Faces

In many cases, the IGES model contains more detail than you need for meshing. The imported geometry for the sedan includes a number of small faces, the edges of which may constrain the mesh generation process unnecessarily. In GAMBIT, you can merge faces together prior to meshing.

1. Merge some of the faces on the sedan hood.



*This command sequence opens the **Merge Faces** form.*



- a) Retain the **Type:Real and Virtual (Forced)** option.
- b) Select (pick) the three faces on the top of the hood as shown in Figure 6-3.
- c) Retain the Merge Edges option to facilitate geometry cleanup during merging.
- d) Click **Apply** to merge the faces as shown in Figure 6-4.

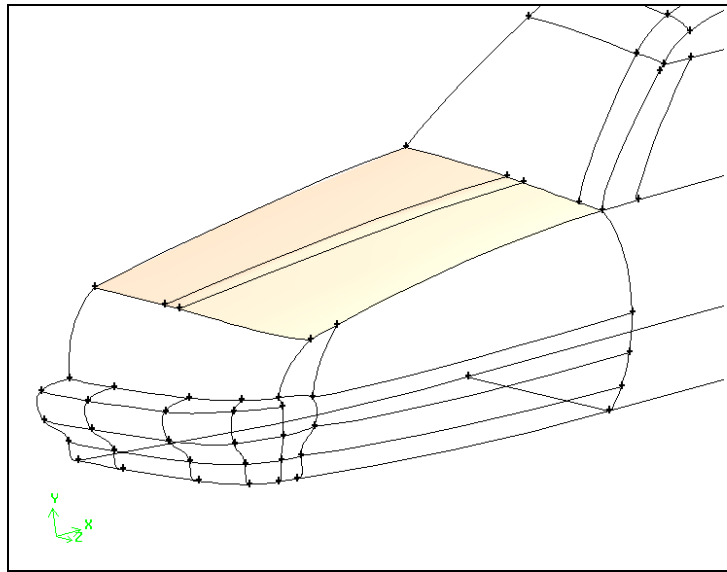


Figure 6-3: Three faces on hood of sedan

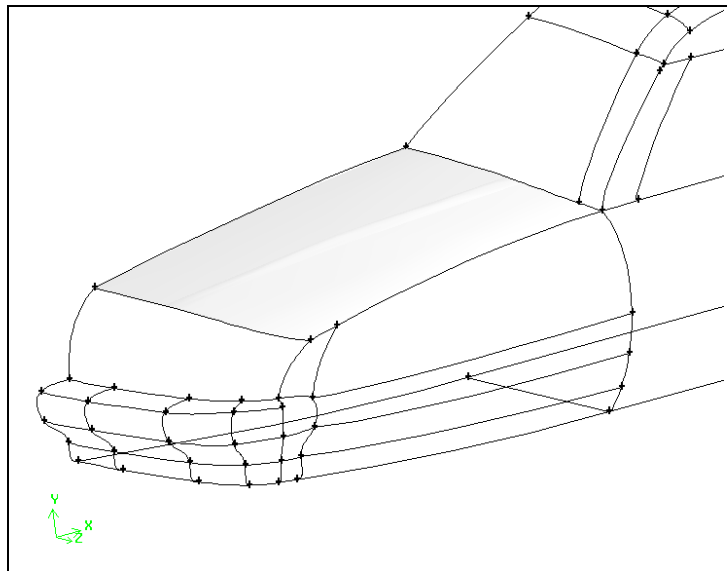


Figure 6-4: Three faces merged on hood of sedan

2. Merge four faces on the trunk of the car (see Figure 6-5) using the method outlined above. The merged faces are shown in Figure 6-6.

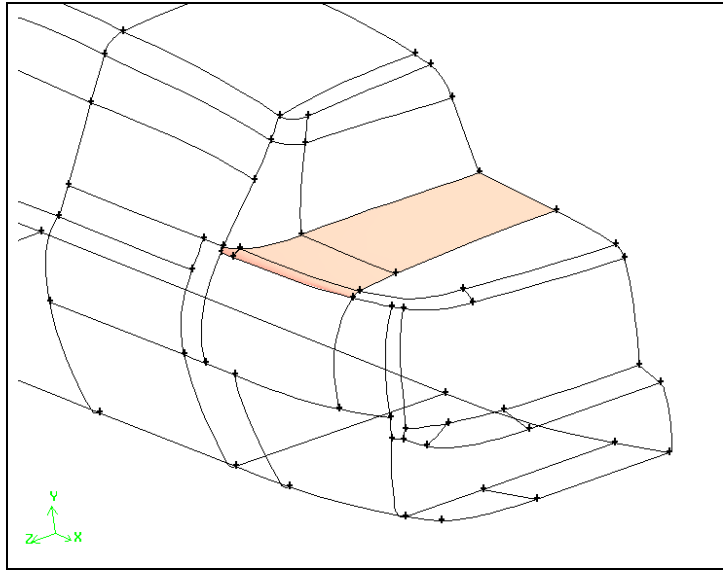


Figure 6-5: Four faces on trunk of sedan

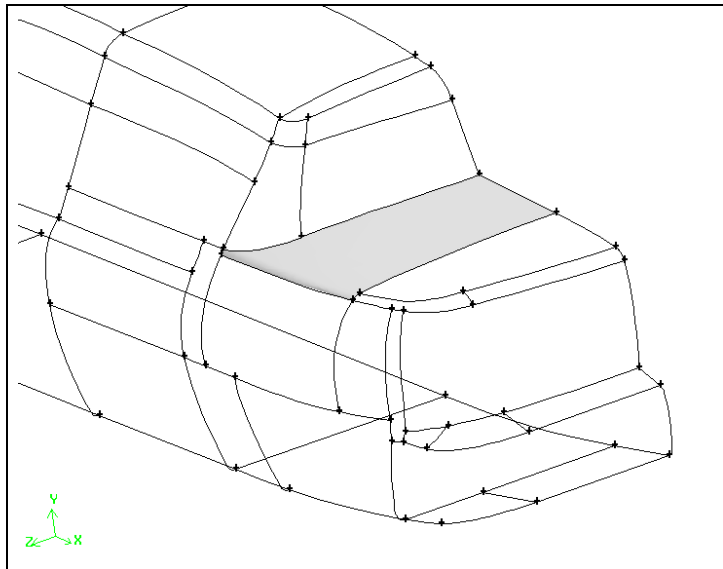


Figure 6-6: Four faces merged on trunk of sedan

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