Geometry Modeling

If your mesh doesn't accurately model the design or if it can't be done within a reasonable time frame, you might as well not perform the analysis. Unfortunately, as most analysts know, importing and using geometry is one of the most daunting problems on nearly every simulation. Gridgen makes it easier by letting you simultaneously work with many types of geometries, quickly create geometry if you need it, and use existing "dirty" geometries without having to do any cleanup.

Hybrid Geometry Modeling

Gridgen uses a hybrid approach to geometry modeling in that it works with different classes of geometry at the same time. While some meshing software limits you to a certain class of geometry data, Gridgen works with three main types:

- Analytic geometry, such as CAD data
- Faceted geometry, like stereolithography files
- Wireframe geometry, consisting of quadrilateral surface patches

Each geometry type has relative advantages and disadvantages, which is why Gridgen supports them all. Also, Gridgen does not require every surface mesh to be associated with a geometric surface. Surface meshes can be created independently in 3D space – planar or curved. This minimizes your dependence on CAD data.

Interoperability

Geometry data is imported from native, standard, and de facto standard file formats.

Gridgen's Native CAD Readers read geometry data in the CAD system's native format thereby eliminating the potential for translation errors. Supported NCR formats include CATIA®, Pro/E®, Unigraphics®, and STEP. Very importantly, the NCRs work without requiring a CAD license so you don't even need the CAD program for the NCR to read the file.

Gridgen's IGES import capability, included with every Gridgen license, has been honed over the years for robustness. Rather than tuning the IGES reader for each CAD system, Gridgen's IGES reader is robust enough to read files that don't strictly conform to the standard (one of the main causes of IGES import failures).

Geometry Creation and Modification

Often the problem with CAD data is that it includes too much detail: for example, an aircraft's interior when an external aero-analysis is to be performed. To combat excessive detail, Gridgen features a layer manager much like the one found in your CAD system. Layer data is imported from the CAD files so the model appears in Gridgen as it does in your CAD system.

Another class of geometry problem involves missing components. Sometimes components are lost during CAD file translation while other times you remove components to simplify the geometry. This can leave holes in the geometry. This class of problem is solved using Gridgen's Coons surface tool. This tool automatically creates an analytic surface over a hole defined by its perimeter. The Coons surface tool automatically trims the curves around the hole's perimeter and identifies the hole's 4 corners.
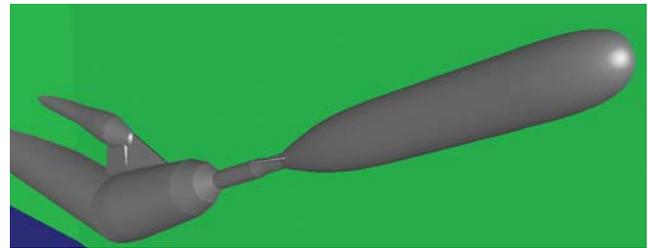

Figure 1. The geometry model for this submarine in a wind tunnel was created entirely within Gridgen. From work done for Defence R&D Canada – Atlantic.

When a Coons surface isn't exactly what's required, you can create many other curves and surfaces in Gridgen. Using these creation tools, you can create complex, realistic geometry models.

Fault Tolerance

For many meshers, "analysis ready" means a perfect geometry model, but CAD geometry often has gaps and overlaps between components that should be adjacent. Gridgen takes a fault-tolerant approach to meshing CAD geometry. Instead of repairing the geometry, Gridgen meshes the sloppy geometry and then automatically merges the mesh over gaps in the CAD. The time saved by not having to clean up geometry can be significant.

The two pictures on this page illustrate what happens without fault tolerant meshing. In figure 2, the geometry model (left) consists of several trimmed surfaces with gaps between them. Without mesh merging, you get one mesh per CAD surface (right) and the meshes are not topologically adjacent.

The Merge command's interactive mode shows why – the red edges in Figure 3 (left) indicate where the mesh has inherited gaps from the CAD model.

When Gridgen's merging is applied – either interactively or automatically at the time of mesh creation – the meshes are merged across gaps in the CAD model. Furthermore, the meshes are joined and smoothed resulting in a single mesh, completely independent of the CAD topology (Figure 3, right).
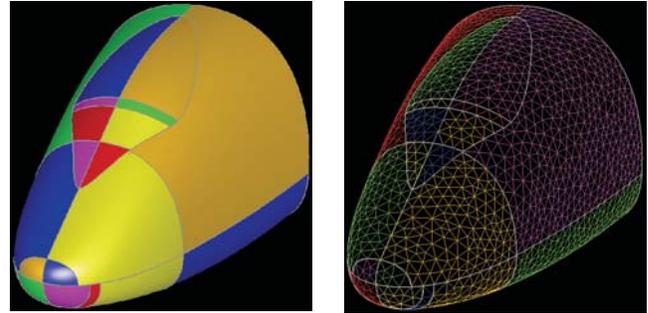

Figure 2. Without Gridgen's fault-tolerant meshing, a complex CAD model (left) gets meshed with one mesh per CAD surface and the gaps remain.
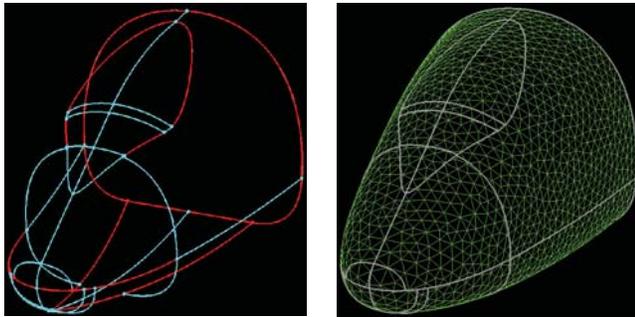

Figure 3. Gridgen's interactive mode for merging shows exactly where gaps are (red, left). Whether interactively or automatically applied, the result is a single mesh that is independent of CAD topology.

Learn More right now!

Gridgen's geometry modeling capabilities exceed most analysts expectations. Your dependence on CAD data is minimized by Gridgen's ability to work with geometry of various types from various formats. You can create complex geometries directly in Gridgen. And fault tolerance means you don't waste time on CAD repair. For more information, visit our web site and we will send you a fully functional Gridgen to try for yourself for 60 days at no charge.

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