VGRID 4.1 ReadMe

TetrUSS now contains VGRID 4.1, a significant upgrade from previous versions. Among other things, this new VGRID contains volume sources (spheres and cylinders), global grid size control, local viscous spacing, and improved NURBS patching. All of these features allow faster, simpler grid generation, with far fewer sources and patches needed than before.

TetrUSS includes 64 bit versions of VGRID and POSTGRID. Installation of X11 is required on Mac OS X, as it is not included with the OS by default.

Some things to be aware of with VGRID 4.1:

1) When using an old project as-is, it is best to leave the d3m version of that project alone (for instance, leave a 3.3 project at version 3.3). This will cause VGRID 4.1 to run in a backwards-compatible mode consistent with specs for the older project. If you do promote the d3m version, make sure that the project is revised to be consistent with later features in VGRID, otherwise unexpected things can happen.

2) Volume sources are available if the d3m version is set to 4.0 or higher. These sources can be used to cover larger regions more effectively than nodal or linear sources. Volume sources specify cell sizing inside and on the surface of the source, then smoothly blend to a mean local field grid size away from the source. These sources have user-defined inner and outer radii, allowing them to cover hollow annular/shell regions if desired (setting the inner radius to zero covers the entire region inside the source). Cylinder sources can have different radii on each end (resulting in conical shapes) and offer stretching in axial or circumferential directions. Be sure this stretching is consistent with the stretching of any other sources in the domain (ie, don't stretch in different or orthogonal directions – stretch everything in the same general direction).

3) Type 2 NURBS patches are available for d3m versions of 3.9 or higher. If you can match a patch to a single underlying surface (using the accept surface or accept active buttons in the patches panel in GRIDTOOL) then the patch will be promoted to type 2. This will tell VGRID to generate mesh triangles directly on the CAD, eliminating the need for follow on projection. Note that the underlying CAD must be of good quality (with clean parameterization, no knots, no singular points, etc) and have a status of "S-33" in the surfaces panel of GRIDTOOL. Surfaces that are not S-33 can be converted to S-33 with the DP to NURBS button in the surfaces panel (this creates a new surface at the bottom of the list).

4) With a d3m version of 4.0 or higher, local viscous spacing can be specified by using non-zero values for delta1, rate1, and rate2 per each source (including different ends of each source). These values will override the global settings. As a default, GRIDTOOL uses a zero for the local values, to turn off local spacing. Be aware -- when reading in an old project, those per-source delta1, rate1, and rate2 values will probably not be zero (older versions of GRIDTOOL did not default to zero), and this will cause local spacing to go into effect if the d3m is promoted to 4.0 or higher. This

is an example of why it might make sense to leave an existing project's d3m version at the old value. Otherwise, you would need to manually set the spacing parameters of each source to the proper value (or zero) before raising the d3m to 4.0 or above.

5) When using a d3m version of 4.0 or higher, additional global grid settings need to be specified. See the global panel in GRIDTOOL. The important settings are dsmin and dsmax, which govern the minimum and maximum cell size in the domain. Set dsmax to the cell size you want in the far field, and note that this capability eliminates the need for placing outer "Box" sources in the domain. Set dsmin to the smallest cell size you want near the body, for instance a typical mean size of triangles you want on an aircraft's surface. VGRID will smoothly vary cell size from dsmin to dsmax through the domain. Note that viscous layer spacing and sources (for smaller leading/trailing edges, sharp edges, corners, etc) will override dsmin locally.

6) Three sample projects are available for VGRID 4.1, and can be downloaded from the TetrUSS website. The ATF sample project (2,391,753 cells) is a revised version of the tailless fighter example used in earlier versions of TetrUSS, setup to use significantly fewer patches and sources when run with VGRID 4.1. The DLR-F6 sample project (19,667,275 cells) illustrates the use of volume sources on the fuselage of a transport aircraft, and corresponds to the configuration analyzed in the AIAA drag prediction workshop (see AIAA 2009-4115). The NACA 0012 project (201,619 cells) is a simple 2D airfoil case.

   These sample projects are available at: http://tetruss.larc.nasa.gov/mac/

7) Please note that NASA Langley is no longer handling training, application support, or user support of the TetrUSS software; these services are now provided by Vigyan at a reasonable cost. For more information, see:

   http://www.vigyan.com/tetruss_training/

   If you are in need of training or consultation, please contact Vigyan to setup an appropriate support plan.