FocusOn Showing Helpful and Unique Features in Pointwise®

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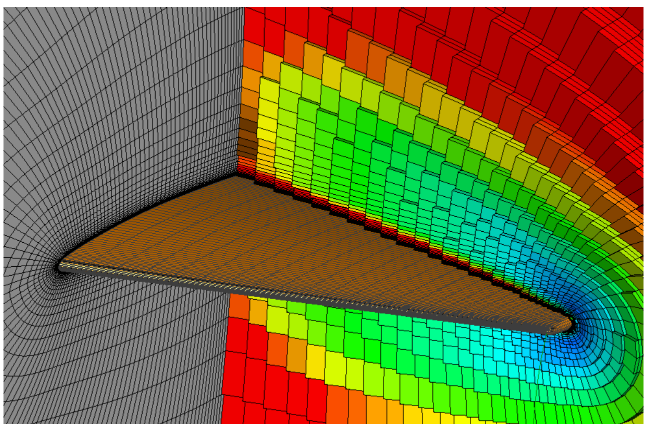
T-Rex: Automated Boundary Layer Meshing

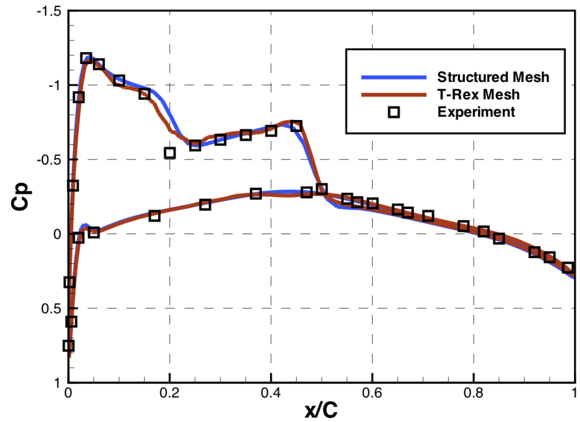
There is an advanced feature in Gridgen that reduces boundary layer mesh generation time from hours to minutes while producing high quality grids that give accurate CFD solutions. This feature, anisotropic tetrahedral meshing, is a little bit hidden, so you may not be aware of it. And that name is kind of hard to remember and pronounce, too, so let's just call it T-Rex.

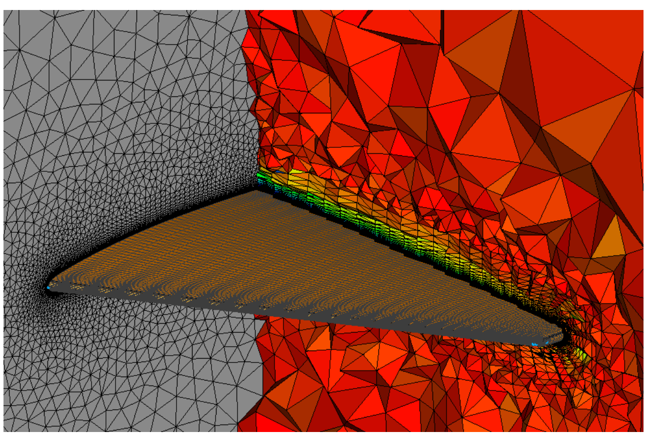
What is T-Rex? It is a technique for extruding regular layers of high-quality tetrahedra from boundaries. The tetrahedra can be recombined into prisms if you prefer.

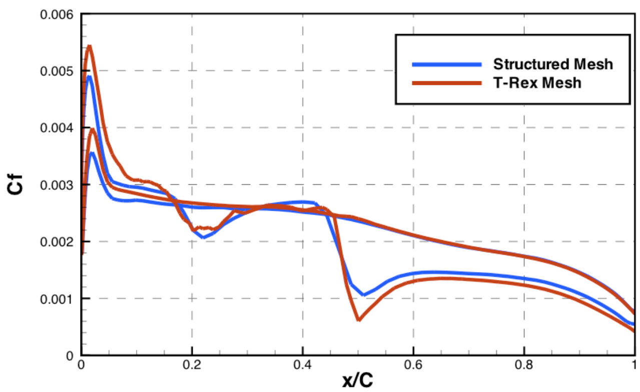
The advantage of using tetrahedra to start the process is that they are fully unstructured. That means the mesh can adjust, or even stop, locally without affecting other mesh regions. This lets us do things like automatically detect convex corners, concave corners, and colliding fronts and provide special handling for them without any user intervention. (That means it is fast!)

Will my CFD code like T-Rex? Yes. T-Rex cells are designed to minimize maximum included angles and cell volume ratios, which are two key characteristics for improved CFD solver









Figures 1 and 2, above: A structured grid (above) and a T-Rex grid (below). Figures 3 and 4, right: These charts show that T-Rex grids produce equivalent solution accuracy to a structured grid, plus T-Rex grids are much easier to build and take only a small fraction of the time needed to make a structured grid.

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accuracy. Figures 1 and 2 show a structured grid and a T-Rex grid for a standard benchmark case, the ONERA M6 Wing in transonic flow.

The CFD results on these two grids are compared in Figures 3 and 4. Figure 3 shows the pressure coefficient distribution at the 65 percent span location. This shows the pressures and shock locations are in agreement between the solutions on the two grids. The basic flow and the interaction between the shocks and boundary layer are correctly captured on the T-Rex grid. Figure 4 shows a plot of skin friction coefficient at the 65 percent span location for both grids. Again, the agreement is excellent.

How can I learn more about T-Rex? A detailed explanation of how T-Rex works can be found here: http://www.pointwise.com/T-Rex. Also, Tutorial 13. DLR F-6 Aircraft: Anisotropic Tetrahedral Meshing in the Gridgen Tutorial Manual shows the mechanics of mechanics of T-Rex meshing in Gridgen. Migration of the T-Rex method from Gridgen to Pointwise already has begun so you should look forward to using it in our next generation software soon.

Figure 5: A high quality T-Rex mesh around an automotive body. The inset image highlights the automatic collision detection between the underbody and ground.