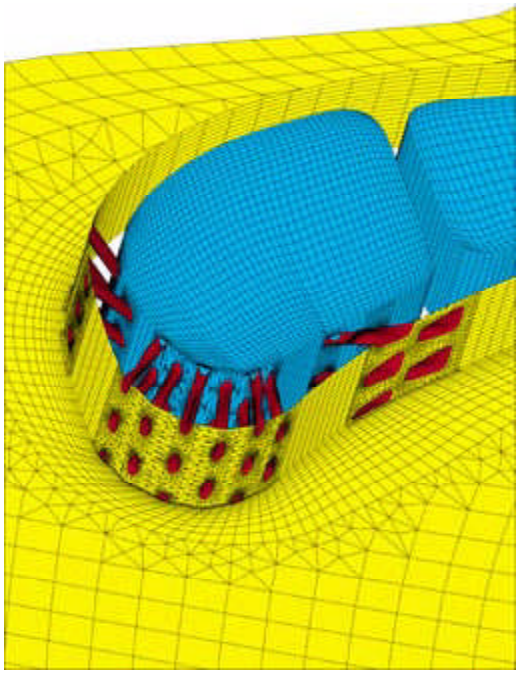
DRAGON Grid: A Three-Dimensional Hybrid Grid Generation Code Developed

Because grid generation can consume 70 percent of the total analysis time for a typical three-dimensional viscous flow simulation for a practical engineering device, payoffs from research and development could reduce costs and increase throughputs considerably. In this study, researchers at the NASA Glenn Research Center at Lewis Field developed a new hybrid grid approach with the advantages of flexibility, high-quality grids suitable for an accurate resolution of viscous regions, and a low memory requirement. These advantages will, in turn, reduce analysis time and increase accuracy. They result from an innovative combination of structured and unstructured grids to represent the geometry and the computation domain.

The present approach makes use of the respective strengths of both the structured and unstructured grid methods, while minimizing their weaknesses. First, the Chimera grid generates high-quality, mostly orthogonal meshes around individual components. This process is flexible and can be done easily. Normally, these individual grids are required to overlap each other so that the solution on one grid can communicate with another. However, when this communication is carried out via a nonconservative interpolation procedure, a spurious solution can result. Current research is aimed at entirely eliminating this undesired interpolation by directly replacing arbitrary grid overlapping with a nonstructured grid called a DRAGON grid, which uses the same set of conservation laws over the entire region, thus ensuring conservation everywhere.

The figure shows the DRAGON grid for a typical film-cooled turbine vane with 33 holes and 3 plenum compartments. There are structured grids around each geometrical entity and unstructured grids connecting them. In fiscal year 1999, Glenn researchers developed and tested the three-dimensional DRAGON grid-generation tools (ref. 1). A flow solver suitable for the DRAGON grid has been developed, and a series of validation tests are underway.



Cut-through view of the DRAGON grid in the leading-edge region of a film-cooled turbine vane, showing the internal plenums and coolant holes inside the vane.

Find out more about this research http://www.grc.nasa.gov/WWW/DragonGrid/.

Reference

1. Zheng, Y.; Liou, M.-S.; and Civinskas, K.C.: Development of Three-Dimensional DRAGON Grid Technology. NASA TM–209458, 1999.

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