Adaptive Strategies For Viscous Simulations

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ABSTRACT

Capturing accurately the whole flow field around a complex geometry remains a challenge for viscous turbulent simulations. The use of quasi-structured boundary layer meshes is required in near-wall regions because of the dramatic variation in the normal direction of some variables such as the velocity.

The scope of this paper is to address this issue from a meshing point of view. We first propose to review the standard approaches [1,4] devised to generate boundary layers meshes: moving mesh methods consisting in moving the front layer in an existing volume mesh, local remeshing methods where patterns are inserted in an existing volume mesh.

We then extend these approaches to devise three mesh adaptation strategies around complex geometries: (i) a fully unstructured approach based on a boundary layer metric, (ii) a mixed approach where the boundary layer mesh is re-generated at each iteration in the mesh adaptation loop, and (iii) a metric-aligned approach, where a single mesh operator is used for both the near-wall regions and the rest of the domain.

The (2D and 3D) test cases considered are a transonic bump, a transonic RAE2822 airfoil, an M6 wing, a geometry from the drag prediction workshop (DLRF6), and a shock/boundary layer interaction. Comparisons of all the approaches are made in terms of robustness, compliance with anisotropic mesh adaptation, CPU time, and compliance with experimental data.

REFERENCES

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