

A DUALISED HEX-MESH GENERATOR WITH CELL QUALITY OPTIMISATION

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The mesh generator snappyHexMesh was first introduced at the 3rd OpenFOAM workshop in 2008 [1]. The current work to develop a new mesh generator for Helyx has been motivated by certain limitations in the snappyHexMesh methodology. In particular, the need to collapse layer cells when mesh quality can no longer be satisfied and jumps in cell volumes at refinement interfaces.

A new meshing methodology has been developed here for achieving full layer coverage without the need to collapse layers locally to satisfy mesh quality.

As a starting point for the meshing the snappyHexMesh refinement engine is used to obtain a base refined Cartesian mesh. To this base mesh a layer of cells, are added at all refinement interfaces. After this layer insertion all touching boundary cells are then split. The mesh is then converted into its dual form. The dualised mesh naturally generates a layer of cells on the surface and in addition to this the cell volume changes at refinement interfaces are reduced.

The mesh is then snapped to the surface and a new cell sphericity optimisation method together with a mesh scaling back approach is used to ensure the final mesh satisfies the desired mesh quality metrics. Additional layer cells can be added and new layer profiles can be specified during the final layer optimisation stage.

An example of the type of mesh generated with 4 layers grown everywhere can be seen in Figure 1 on the ERA car [2]

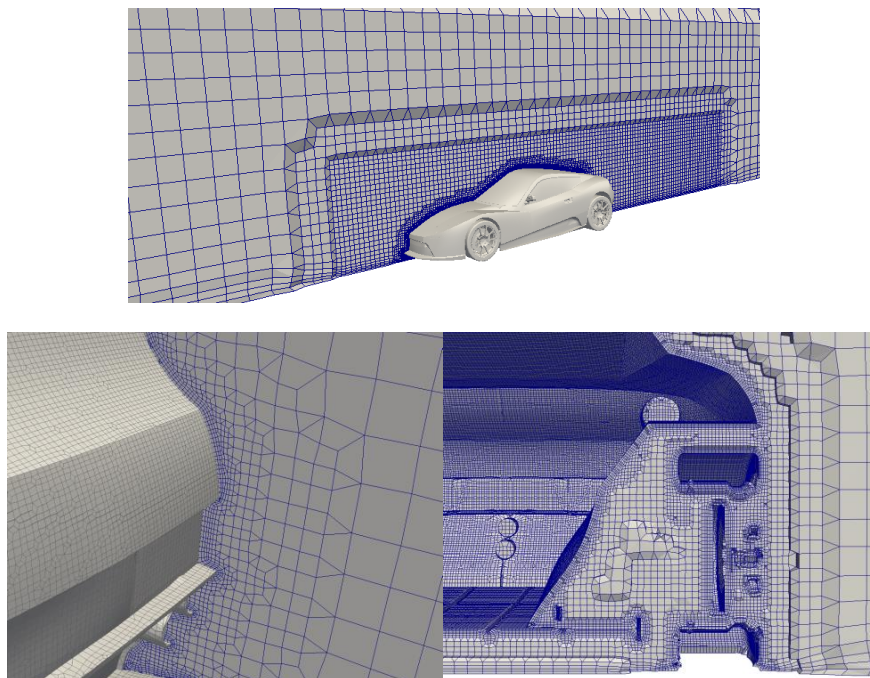


Figure 1: Mesh Generated on ERA Car

References

- [1] E. de Villiers, A. Jackson and M. Janssens, Automatic Parallel Polyhedral Mesh Generation on Complex Geometries in OpenFOAM, Third OpenFOAM Workshop, Politecnico di Milano, 2008.
- [2] Electric Raceabout, www.raceabout.fi/era/home, Accessed 2011-01-09, (2011)