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SIMULATION OF TURBULENT FLOWS PAST 3D COMPLEX GEOMETRIES USING ANISOTROPIC ADAPTATION TECHNIQUE

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The paper presents algorithm used for simulations of high-Reynolds turbulent flows past 3D complex geometries using anisotropic adaptation. The adapted simulation algorithm relies on full remeshing of the grid at every adaptation step. The algorithm starts with initial coarse grid which is not yet adapted. The solution obtained on the initial grid is passed to error estimator which creates a *Control Space* defining desired anisotropic cell spacing for a new grid. Then the new grid is generated with anisotropic hybrid grid generator and simulation is restarted.

The key ingredients of the simulation apart from the solver are anisotropic grid generator and error estimator. The grid generator must be able to create a new grid according to the *Control Space* which can be quite challenging especially in the area of high shear forces (boundary layer). It is solved by using hybrid approach to grid generation using frontal semi-structured generator for thin boundary layer grid and unstructured one for remaining space. Example of grids can be seen on Figure 1.

Second important element is error estimator. The estimator used in the presented simulations is based on mixed hessian–gradient approach [2] which allows in better way to extract details of the viscous shear layer like boundary layer or wake. Propositions of modifications to the estimator based on viscous tensor and vorticity will also be presented.

The results of the simulation using presented algorithm will be shown for the High Lift Prediction Workshop 1 testcase [1]. The geometry can be seen on Figure 1 and it consist of body and trap wing with extended slat and deflected flap. Example of the c_p distribution for the section near the wing tip is shown on Figure 2 where the results for consecutive adaptation steps are compared to the experiment.

Most work presented here and related to hybrid grid generation and error estimator was done in frame of IDIHIOM project.

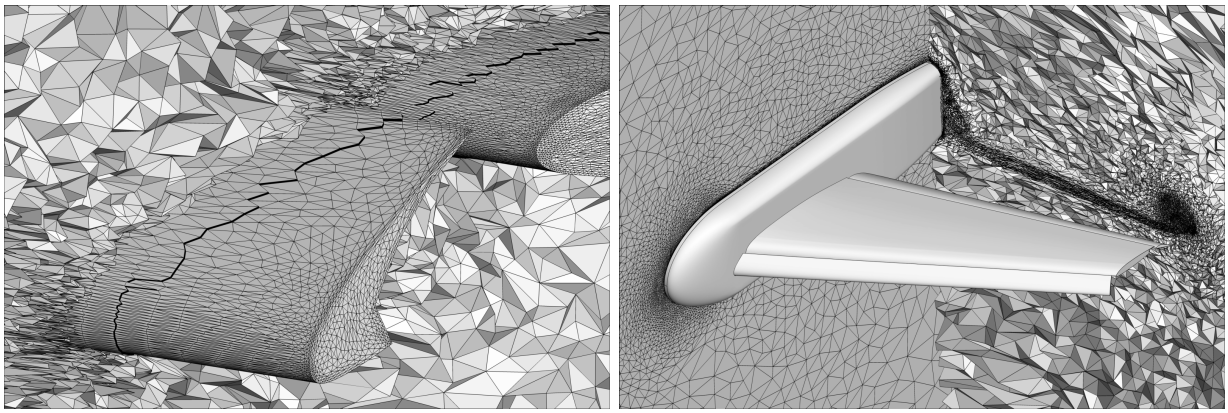

Figure 1: The grid after 3 adaptation steps for HLPW–1 geometry

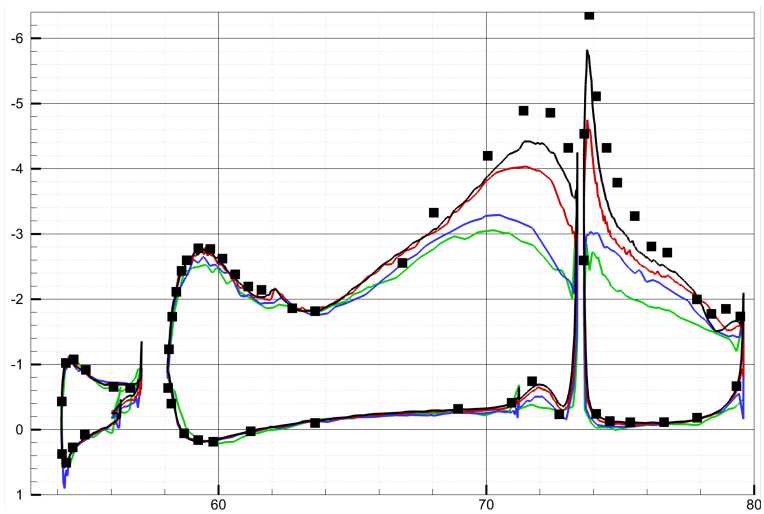

Figure 2: Comparison of the c_p distribution at section $y/b = 0.98$ (— initial, — 1st adaptation, — 2nd adaptation, — 3rd adaptation, ■ - experiment)

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