Session:

Application of DDES to Iced Airfoil in SU2

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This paper presents the investigation of the turbulent flow around Gates Learjet Corporation-305 airfoil with a leading edge horn-shape glaze ice using Delayed Detached Eddy Simulation (DDES) based on the Spalart-Allmaras turbulence model. The DDES algorithm implemented within the Stanford University Unstructured (SU2) solver [1], which is an open-source unstructured finite-volume code, was used for all the simulations.

During the last few years, several developments and implementations were made by the authors towards the mitigation of the delay in the transition from RANS to LES (the so called "grey area") in free and separated shear layers [1-2], including the implementation of low-dissipation and low-dispersion numerical scheme [3] and different subgrid length-scales: the vorticity-adapted [4] and the shear-layer adapted [5]. Although the delay issue is not completely solved and a perfect solution can hardly be expected, the authors continue to pursuit effective remedies to allow a significant shortening of the grey area in a non-zonal unstructured code. For this industrial-relevant test case, the recent stochastic backscatter model proposed by Kok [6] was implemented and will be tested in conjunction with the others already mentioned remedies.

The primary objectives are to capture unsteady flow features as shown in Fig. 1, separated coherent structures and also relax the meshing requirements to improve accessibility to turbulence-resolving methods for more realistic configurations, e.g. full aircraft with ice shapes. Comparisons will be made with experimental data for several angles of attack, including forces, moments, wall pressure coefficients, Fig.2, and velocity profiles.

References

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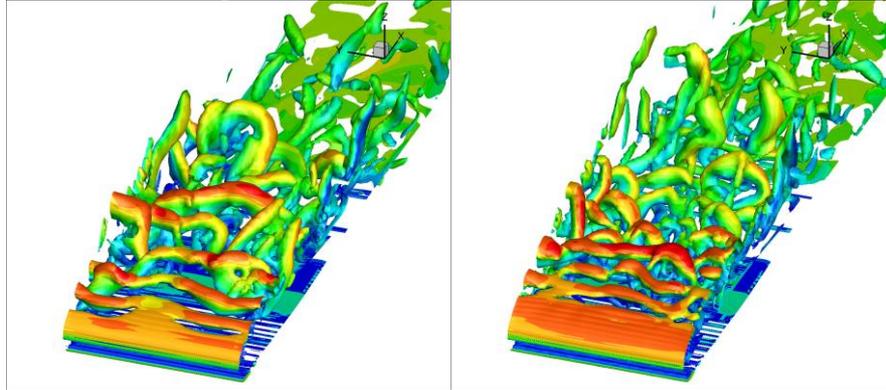

Fig. 1: Comparison of instantaneous iso-surface of Q-criterion: Baseline (left) and fine mesh (right).
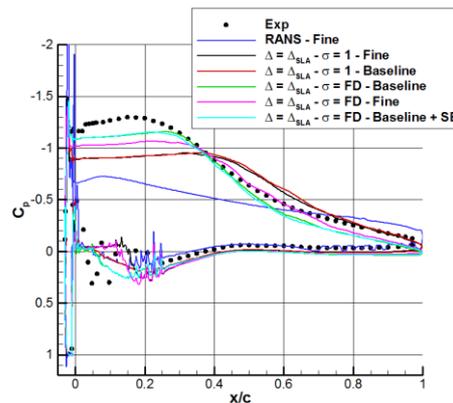

Fig. 2: Comparison of pressure coefficient at AoA=6.0º.

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