Abstract Submitted
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Adaptive simulations and experiments of the turbulent flow around a NACA 4412 profile at high Re[1] FERMIN MALLOR, ALVARO TANARRO, EDA DOGAN, AGASTYA PARIKH, NICOLAS OFFERMANS, ADAM PEPLINSKI, RAMIS ÖRLÜ, RICARDO VINUESA, PHILIPP SCHLATTER, Linné FLOW Centre, KTH Mechanics — Turbulent boundary layers (TBLs) under strong pressure gradients (PG), as appearing on wing surfaces, are still an active research topic. The NACA 4412 has been a benchmark airfoil in the study of PG-TBLs as its surface pressure distribution is only weakly dependent on Reynolds number (Re) at moderate angles of attack (AoA). This allows to decouple PG (history) and Re effects affecting the development of the TBL. Using the high-order spectral-element method code Nek5000, large-eddy simulations of a NACA 4412 profile at a 5^o AoA are carried out. Adaptive Mesh Refinement (AMR) is used to generate a non-conformal mesh highly refined in the boundary layer and wake regions and avoiding the over-refinement of the far-field typical of structured conformal meshes. A larger domain is used while reducing by a factor of three the number of grid points, allowing to increase Re, aiming for 1,640,000 used in the experiments of the 1970s and 80s on the same airfoil. Such well-validated simulation data can then be used to understand better the effect of PG and surface curvature, and allow the calibration of turbulence and wall models. Moreover, an experimental campaign is planned in the MTL wind tunnel at KTH, for which wall liners are designed aiming at reducing blockage effects.

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