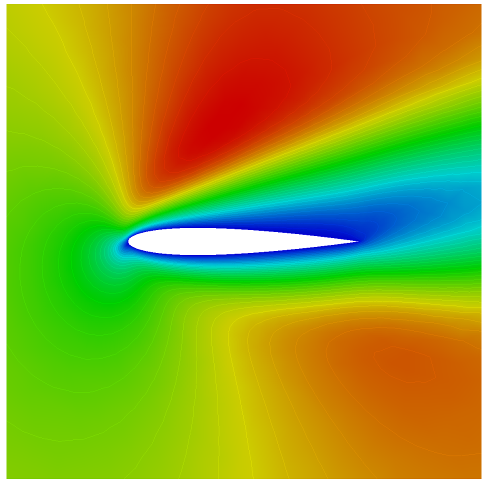

Figure 1: Mach field and contour of the viscous laminar Navier-Stokes flow solution for the NACA0012 airfoil, $M_\infty = 0.8$, $\alpha = 10°$, $Rey = 73$.

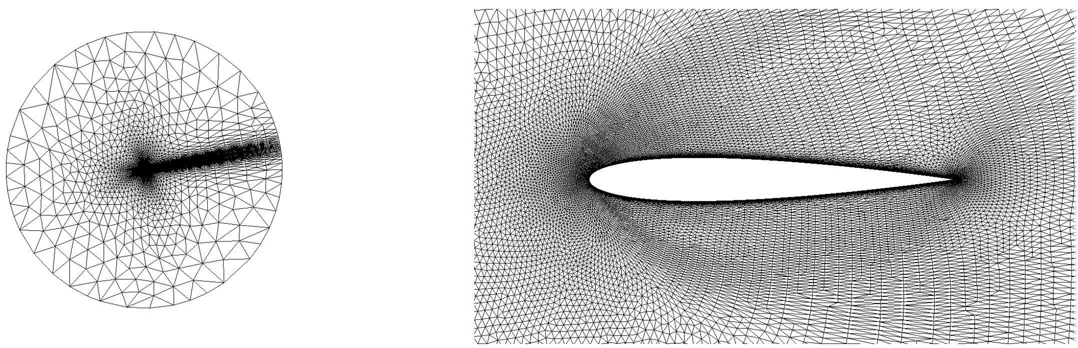

Figure 2: Goal-oriented adapted mesh after 6 fixed-point iterations ($C = 16000$) for laminar viscous flow with $M_\infty = 0.8$, $\alpha = 10°$, $Rey = 73$.

both methods impose finer resolution in these parts but it appears definitively that the viscous error terms govern the overall mesh adaptation. These remarks are strongly confirmed by the convergence curves of the drag and its viscous component presented in Fig.4. Euler-based adaptation is definitively less good than no adaptation. A mesh convergence analysis has been performed, see Table 1 and Figure 4. We compared the C_D values obtained for different sizes of goal-oriented adapted meshes, with and without the viscous fluxes, and equivalent sizes quasi-uniform meshes.

For comparison we have a calculation of Mavriplis and Jameson [**?**] performed with a rather well generated medium-fine mesh (23680 nodes) and we have computed the flow with a fine mesh of 486388 nodes. Both computations give the same pressure drag with four digits.

A non-adaptative sequence of mesh is also generated from a rather good coarse mesh with 6080 vertices into a medium one of 12021 vertices and a fine one of 22766 vertices with similar distributions of their vertices. We refer to them as quasi-uniform refinement.

Our coarsest mesh-adapted calculation of 6558 nodes and our finest one deviates from reference results by less than 0.3 %. Depending on how we identify the “exact” value, mesh adaption seems to produce same error level as non-adaptive computations with at least four times more vertices. Our calculations are performed with a fixed computational domain with farfield boundary at 20 chords, instead of increasing its size. Within this limitation, we have evaluated the numerical convergence order of the three adapted calculations. The observed convergence order of the pressure component of drag is aberrantly large. We have to remember that our adaptation with complete remeshing carries more numerical noise than an usual mesh division. However, it indicates that this quantity converges more easily than the complete drag. The observed convergence order of the complete drag turns out to be 1.87, a reasonable figure for this kind of output. We also observe that mesh local stretching remains modest, with aspect ratios in boundary layers less than 3-5.