DEVELOPMENT OF VERY HIGH ORDER RESIDUAL DISTRIBUTIVE SCHEMES APPLICATION IN AERO-ACOUSTICS

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This project is concerned with the development of third and fourth order residual distribution schemes for compressible flow with shocks. Indeed, it is now widely recognized that very higher order schemes offer a potential of higher efficiency and are even critical for certain applications like aero-acoustics, but also for LES and DNS. In this optics the goal of this Phd is to construct monotone third and fourth order residual distributive schemes and to apply them in aero-acoustics problems for sound propagation using the linearized Euler equations.

The method starts from a finite element approximation on Lagrangian elements of arbitrary order defined on triangular elements (P1, P2, P3 ...). It uses a sub-triangulation of the higher order element to distribute in a nonlinear way the higher order residual computed on the sub-triangle, towards the nodes of the sub-triangle. Over the last year the improvement of the shock detection and the high order descretization of source terms have been developed. Figure 1 and Figure 2 show the propagation of an acoustic monopole in a Mach 0.5 mean flow (by Linearized Euler equations) using second order (figure 1) and third order (figure 2) scheme. An improvement can be noticed for the third order solution on the upstream waves. On figure 3, the third order Euler solution is shown for a NACA0012 profile at M=0.8.







Figure 2: Solution of the propagation of a monopole in a Mach 0.5 mean flow. Slice at y = 0, zoom in on the upstream wave

Figure 3 : Isomach contours of the third order solution for a NACA-0012 profile at M=0.8