ESTIMATES-AND-CORRECTOR-BASED MESH ADAPTATION

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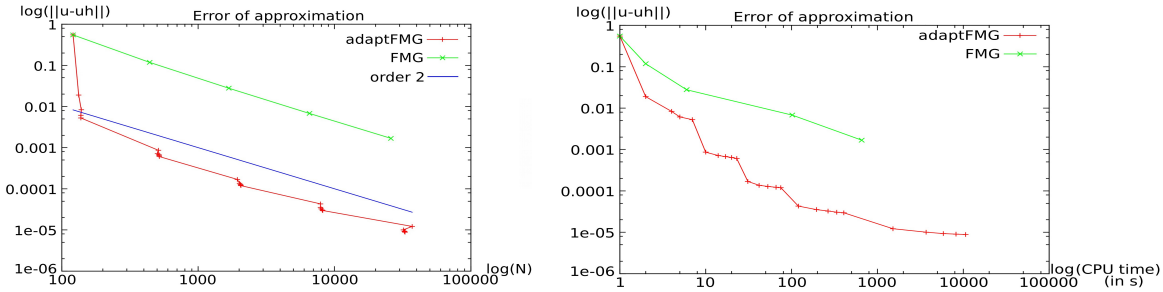
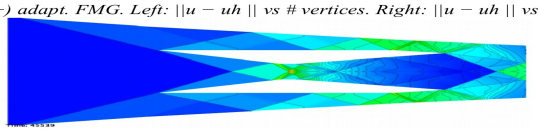
ABSTRACT

The proposed communication concerns the need in accuracy in CFD, addressed by mesh adaptation. In the recent years, the formulation of mesh adaptation statement was much improved by the combination of (1) a better identification of the unknown, the metric parameterizing the adapted mesh and (2) approximation errors to minimize. In goal-oriented formulations, the approximation error committed on a scalar output expressed in terms of the solution field is minimized. This is made possible thanks to an error estimate and an adjoint state. The communication will discuss the building of a local estimate the sensitivity of which to mesh-metric can be explicitly exhibited [1]. In norm-oriented formulations [2], a norm $|u-u_h|$ (for example a L2 norm) of the approximation error is minimized, where $Au=f$ *(exact)* and $A_h u_h=f_h$ *(approximate)*. The exact solution u being unknown, the norm $|u-u_h|$ needs to be accurately approximated by a so-called corrector. A rather good compromise between accuracy and computational cost is to use as corrector a finer-mesh Defect-Correction corrector as in multi-grid: $u_h'=(A_h)^{-1}R(A_{h/2}Pu_h-f_{h/2})$ where R passes from grid h/2 to grid h and P from h to h/2. The novel formulation relies on the association of the corrector field u_h', an adjoint state and the above local estimate. The calculation of a boundary layer with an error of 0.1% is obtained in 10 secs of adapted FullMultiGrid, vs 1000 secs of FMG. The application to Euler flows is illustrated with the scramjet flow of second figure. Extension to Navier-Stokes is on-going.



(×) FMG, (+) adapt. FMG. Left: ||u − uh || vs # vertices. Right: ||u − uh || vs CPU.



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