Adaptive methods for CFD: from theory to industrial applications

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ABSTRACT

Numerical methods for partial differential equations based on adaptive meshes have been proposed since the eighties, first by covering several theoretical settings (from linear to nonlinear problems, from steady to unsteady settings), and successively becoming instrumental to a huge variety of applicative fields. In particular, numerical discretizations based on adapted computational grids allowed to attain results which were out of range with traditional computational tools.

Different toolboxes may be required to generate an adaptive discretization of the computational domain:

- Mesh modification mechanisms, possibly driven by an error assessment;
- A posteriori metric-based mesh generation driven by robust error estimates;
- Strategic implementation confirming an evident reduction of the global computational effort;
- Goal-oriented adaptivity and/or optimal mesh generation;
- Conservative interpolation from mesh to mesh;
- Parallel computing with remeshing and repartitioning of the whole computational effort.

The objective of this Minisymposium is to gather researchers working in the field of adaptive meshes for CFD simulations, to offer a rich panorama on the state of the art and, at the same time, significative instances of applications in CFD where adapted meshes play a crucial role. The topics covered by the speakers will range from computable error estimators (interpolation, a priori or a posteriori error estimates, space and eventually time) and academic benchmarks, to industrial applications in CFD, such as multiphase problems, turbulence modeling, Newtonian or viscoelastic fluids, kinetic formulations, uncertainty quantification.