ANR ANVES Project – INSA de Rouen – CORIA UMR 6614

Advanced numerics in fluid mechanics for virtual prototyping of energetic systems: High-order schemes for high-fidelity LES of complex geometries

Resume

The objective of this project is the development of high-order numerical methods for the computation of turbulent flows over complex geometries. The context is that of discontinuous finite elements (DFE) methods applied to Large-Eddy Simulation (LES). These methods allow to perform the numerical simulation of turbulent confined flows preserving numerical accuracy regardless of the mesh and the geometry. Specific efforts will be done to develop dedicated selective dissipation operators to be used in conjunction with a similarity term and to couple a detailed description of Reynolds-averaged turbulent boundary layers with large-eddy simulation. In order to allow the use of explicit filtering sub-grid scale modeling approaches, dedicated filtering operators or strategies will be developed for these high-order methods on a general class of simplex element types for hybrid unstructured meshes.

Research program

The proposed research is mainly focused on the development of dedicated operators and modeling strategies to perform high-fidelity LES computations of turbulent flows over complex geometries. At the core of these activities is the ongoing development of an MPI parallelized fortran 90 numerical solver for compressible flows based on the DFE method, namely, the high-order Spectral Difference (SD) scheme.

A 15 months postdoctoral appointment will be available starting on January 2015 and the relevant envisaged activities will be aimed toward

- the generalization of the numerical solver to simplex elements;
- the development of high-order filtering operators with specified cutoff length-scale for DFE methods on unstructured hybrid meshes;
- the development and validation of advanced strategies to model turbulent dissipation via spectral (or modal) selective operators to be coupled with a similarity term.

Candidate profile

The candidate should hold a PhD degree in Engineering (Aeronautical, Mechanical), Physics, Applied Mathematics or related fields and have a significant experience in the development and implementation of numerical algorithms for Computational Fluid Dynamics with particular emphasis on applications to LES over massively parallel environments. A good proficiency with the Fortran language is desired.

Prior experience with DFE methods such as Nodal Discontinuous Galerkin, SD or Flux Reconstruction will be highly appreciated.

Informations

Location: CORIA Laboratory, Rouen, France – www.coria-cfd.fr

Duration: 15 months (starting on January 2015)

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