Postdoctoral position on scientific computing/CFD

Development of efficient p-multigrid methods for the simulation of stationary turbulent flows

- Recruitment grade: young researcher
- Location: University of Pau, France
- Starting date: January, 1st 2024
- Duration : 1 year
- Gross salary: $\approx$ 2500 €/month.
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Detailed work

This topic is part of the ASTURIES project, which aims at developing innovative CFD methodology based on hybrid RANS/LES. It aims at developing

- advanced near-wall turbulence closures,
- high-order numerical methods for complex geometries
- criteria for identification of relevant physical RANS-to-LES switchover

This postdoctoral position is part of the effort on the high-order numerical methods for complex geometries, more precisely on the acceleration of the convergence towards a stationary state.

Discontinuous Galerkin methods are able to provide very high order accurate numerical solutions. This methods is compact, namely cells are only communicating with neighbouring cells, still, the higher degree is used in each cell, the more unknowns are stored inside each cell. This leads to matrices that are block sparse, but with large and dense blocks. Assembling the matrix becomes itself a costly step, as well as the inversion of the system.

A way to circumvent the assembling of the full matrix consists in using p-multigrid as a preconditioner: the smoother is used on each of the degrees, execpt on the coarsest one, on which the assembling is done (but matches with the cost of the finite volume method, which is affordable).

The aim of this position is to develop a p-multigrid method for the computation of compressible stationary flows with discontinuous Galerkin method, either laminar with the compressible Navier-Stokes system, or turbulent with RANS models. This method will be tested with simple geometries, like the turbulent channel flow, but with fully unstructured, possibly distorted meshes, for assessing the robustness of the numerical methods.

Skills required

- Background in simulation of compressible flows.
- Knowledge of C++.
- Experience with using large computing clusters.
- Background in multigrid methods.