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P R O J E C T

Development of low-order shock-capturing scheme for discontinuous Galerkin method

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Supervisors

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A B S T R A C T

Computational challenges in hypersonic flow simulations are crucial in order to develop technological application ranging from space vehicle design to mitigation of space debris. Despite a vast range of numerical method used in Computational Fluid Dynamics (CFD), the simulation of hypersonic flows remains a challenge mainly because of the critical phenomena occurring along the shock.
The most used scheme to tackle the Navier-Stokes equations is, until today, the Finite Volume Method (FVM) because of its ability to fit different types of meshes. Other methods such as the Flux Difference Splitting or the Flux Vector Splitting are added (for the convective term) to resolve the shock discontinuities monotonically without violating the entropy condition.
The Discontinuous Galerkin Method (DGM), which is a more accurate (high-order) and general scheme (that include the FVM) have shown promising results in the Argo Platform. However, the solver is not robust along strong shocks on unstructured grids.
The general aim of the project is to build a hybrid solver which uses a degraded-order scheme in the shock region for hypersonic applications.
The first step is to get familiar with the Argo platform and run a case that uses the DG method to compute the Navier-Stokes equations on a specific hypersonic test case.
The second step is to add to the DGM a low-order reconstruction method (P0) on the shock region in order to reach a reasonable compromise in term of accuracy and robustness.
The last task is to test and analyze the hybrid approach on the considered case.

KEY WORDS: *Computational Fluid Dynamics, Discontinuous Galerkin Method, hypersonic, shock, hybrid solver, Argo Platform*

Resources Required

- Computational: VKI Cluster

Suggested Evaluation Team

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