ADVANCED NUMERICAL METHODS FOR FLUID FLOWS

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ABSTRACT

The exponential growth in computational power over the last decades has solidified Computational Fluid Dynamics (CFD) as a crucial tool in countless industrial applications. While advances in algorithms have significantly contributed to its appeal, further improvements are still required to make CFD more competitive in terms of solution accuracy and simulation time. To this end, there is a need to produce numerical methods that are able to provide highly accurate solutions at a reasonable cost by improving the numerical properties of the scheme, such as robustness, stability, and efficiency.

The aim of the mini-symposium is to bring together a community of young researchers working on the development and the application of advanced numerical methods in the field of fluid dynamics. Particular focus is given to high-order and/or high-resolution schemes whose objective is to obtain solutions with high-fidelity and which are highly efficient in terms of computational cost. The numerical strategies employed may include finite difference, finite element, continuous/discontinuous Galerkin, spectral methods, among others.

The high fidelity provided by the physics compatibility may be achieved, for example, by means of property-preserving methods, novel shock-capturing techniques, cutting-edge turbulence models (e.g., transition models, hybrid RANS/LES approaches), or the innovative integration of machine learning methods. The attainment of fast computational times may rely on HPC parallelization, machine-learning accelerated algorithms, adaptive time-stepping schemes, and other numerical artifices.

The mini-symposium also invites contributions demonstrating the application of these methods to solve complex flow problems with accuracy, efficiency, and robustness. Topics of interest include, but are not limited to, compressible aerodynamics, hydrodynamics, biophysical applications, heat transfer and combustion, plasma fluid dynamics, environmental flows and multiphase problems.