FACING THE CHALLENGES OF HIGH ORDER METHODS FOR HYPERBOLIC PDES

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ABSTRACT

In recent years, there has been a growing focus on the design of (arbitrarily) high-order methods for hyperbolic differential problems. In fact, such methods are well known to *better* approximate the solution and to provide higher accuracy for coarser discretizations, often resulting in strong computational advantages.

However, increasing the order of accuracy brings along its own set of challenges. Simulations using these methods often encounter difficulties such as instabilities, blows-ups, violations of physical properties, as well as technical issues when applied to complex models. Moreover, the computational costs of arbitrarily high order methods can easily increase because of time step restrictions or the number of stages involved. Hence, current research focuses on building (arbitrarily) high order schemes that are also (nonlinearly) stable, robust and efficient.

Nowadays, as high order methods are becoming well established and mature, the need to solve these outstanding issues is more and more pressing. With this minisymposium we try to answer the following question: how to develop effective high order methods for hyperbolic problems?

In this minisymposium, we envision the following topics to be addressed:

1) arbitrary high-order methods for hyperbolic PDEs with any discretization technique (finite difference, finite volume, finite elements, discontinuous Galerkin, summation by parts, etc.),
2) structure preserving methods (positivity, entropy, energy, divergence-free, etc.),
3) shock capturing methods,
4) high-order schemes for multi-dimensional and multi-physics hyperbolic systems,

5) asymptotic preserving methods,
6) efficient implementation of high-order hyperbolic solvers,
7) adaptive refinement strategies,
8) parallel implementations, parallel algorithms and GPU computing for high-order methods,
9) error estimation, stability analysis, and convergence properties of high-order schemes,
10) applications of high-order methods in engineering and scientific problems.

The objective of this minisymposium is to bring together researchers and practitioners from different disciplines to discuss novel techniques, applications, and theoretical developments in the field, encouraging discussion, knowledge sharing and collaborations among researchers.