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Well-balanced Schemes for Hyperbolic Systems with Source Terms

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ABSTRACT

Hyperbolic systems with source terms describe many physical phenomena, and as such they are of particular interest to applied researchers. A well-studied example of such a system, among many others, is the shallow water equations. This system is of prime importance in real-world applications, such as the simulation of tsunamis, river flows or flooding. Other notable systems include for instance the Euler equations with gravity, which are often applied to astrophysics simulations, or the equations to model blood flow.

It has been well-known for twenty-five years that numerical schemes may introduce large errors when simulations involve near-stationary solutions. To address such an issue, well-balanced schemes have been proposed in order to exactly capture and preserve these steady states.

Such well-balanced schemes are often built to be first-order accurate. To perform simulations of real-world phenomena, high-order extensions are required to increase the accuracy of the scheme. In addition, the resulting high-order well-balanced schemes have to satisfy supplementary properties, like the preservation of invariant domains, the correct treatment of non-conservative products, or the satisfaction of discrete entropy inequalities.

During the last 25 years, multiple methods have been deployed to accurately approximate the systems under consideration. For instance, finite difference schemes, finite volume schemes or discontinuous Galerkin methods are especially popular, especially when considering high-order extensions of well-balanced schemes.

The main objective of this Minisymposium is therefore to bring together the active community of researchers working on well-balanced schemes for hyperbolic systems with source terms to present their latest results.