Active Flux Central-Upwind Schemes for Hyperbolic Systems of Conservation Laws

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ABSTRACT

In this talk, I will present two novel approaches for constructing active flux (AF) methods.

First, I will introduce a new semi-discrete finite-volume (FV) AF method based on overlapping meshes. Like many existing AF methods, the approach relies on both the conservative and nonconservative formulations of the underlying hyperbolic system. The conservative system is discretized on one of the meshes using a simple numerical flux that does not require any limiting procedures. The nonconservative system is handled using a path-conservative central-upwind scheme. To ensure non-oscillatory behavior and convergence toward the physically relevant solution of the original conservation laws, a special conservative post-processing step is employed at the end of each time step.

Second, I will present an alternative, non-staggered semi-discrete AF method in which both the conservative and nonconservative systems are discretized on the same FV mesh. Here, the conservative system is solved using a low-dissipation central-upwind (CU) scheme, and the post- processing procedure is simplified. This second version yields sharper solutions, facilitates extension to multifluid computations, enables efficient and robust scheme adaptation enhancement, and leads to novel asymptotic-preserving AF-CU schemes, which will be presented in a talk by Alexander Kurganov.

This is a joint work with Remi Abgrall (University of Zurich, Switzerland), Alexander Kurganov (SUSTech, China), and Lorenzo Micalizzi (NC State University, USA).