Fully Discrete Active Flux Methods for Hyperbolic Problems

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Abstract:

The Active Flux method is a finite volume method for hyperbolic conservation laws that uses both cell averages and point values as degrees of freedom. Several versions of such methods are currently under development following the pioneering work of Eymann and Roe.

I will present our recent work with Amelie Porfetye and Erik Chudzik on fully discrete Active Flux methods for two-dimensional hyperbolic systems, with focus on the Euler equations. These methods require exact or approximative multi-dimensional evolution operators to update the point values. In our method, these operators are provided by the method of bicharacteristics, developed in previous work by Lukacova et al., which solves a local linearisation of the nonlinear hyperbolic problem. We analyse the linearisation error and propose new, third order accurate, fully discrete Active Flux methods with a compact stencil in space and time. Furthermore, we discuss limiting techniques, adaptive mesh refinement and the implementation of boundary conditions. Numerical results will illustrate the performance of the resulting method.