Active Flux Methods for Hyperbolic Systems Using the Method of Bicharacteristics

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We present a new Active Flux finite volume method based on the approximate evolution operator using bicharacteristics. The method of bicharacteristics is used for the derivation of truly multidimensional approximate evolution operator that can be used for the evolution of point values in Active Flux methods. The resulting third-order method is fully discrete and has a compact stencil in space and time. However, stability imposes stringent requirements on the CFL criterion. In order to improve the stability, we propose a new evolution operator derived using a planar solution of the wave equation with quadratic initial data. Further, we present our recent results on the convergence analysis via dissipative measure-valued solutions and weak-strong uniqueness principle. Consequently, we show that the first order variant of the Active Flux finite volume method converges strongly to a strong solution of the multidimensional Euler system as long as the latter exists. Numerical results confirm accuracy and stability of the resulting Active Flux method.

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