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On the stability of fully adaptive multiscale schemes for conservation laws using approximate flux and source reconstruction strategies

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Keywords: conservation laws; finite volume schemes; fully adaptive multiscale; numerical flux; biorthogonal wavelets

Review text:

The aim of this article is to propose an approximate flux and source reconstruction strategy. The basic idea is to compute, for each cell in the adaptive grid, a reconstruction polynomial by which the authors provide the data for the computation of the local fluxes. Moreover, the local sources are determined by a quadrature rule applied to the composition of the source function and the reconstruction polynomial. It is proved that this strategy does not spoil the computational complexity of the adaptive scheme even in higher dimensions. Furthermore, it is verified analytically that in this way the accuracy of the reference scheme can be maintained, i.e., the perturbation error introduced by the adaptive procedure is controlled by the threshold parameter in such a way that is the same order as the discretization error of the reference scheme. In particular, by evolving the partial differential equation on adaptive grid using the approximate reconstruction strategy, the authors introduced an additional error in comparison with the evolution with exact reconstruction. This error is proportional to the threshold value. The theoretical results are confirmed by numerical parameter studies.

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