Adaptive parallel space-time discontinuous Galerkin Methods for the linear transport equation

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We consider variational space-time discretizations for the linear transport equation with full upwind discontinuous Galerkin methods in space and time. Based on our convergence analysis for symmetric Friedrichs systems in a mesh-dependent DG norm we construct an error indicator and show numerically that the adaptive method is efficient. The linear system is solved by a multigrid method in space and time, and we show numerically that the convergence is of optimal complexity. We observe that convergence is obtained also in case of discontinuous solutions without regularity requirements. Then we show that in case of local sources and local goal functionals the computational domain can be restricted to a subset of the space-time cylinder and that then a suitable parallel strategy results in a significant reduction of the computational effect. Finally, the discretization is compared with the analysis of an overlapping DGP method which provides convergence estimates with minimal regularity requirements.

References:

[1] https://doi.org/10.1016/j.camwa.2023.10.031

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