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Adaptive Discontinuous Galerkin Method for Elastodynamics on Unstructured Spacetime Grids

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We present an adaptive implementation of a spacetime discontinuous Galerkin (SDG) method for linearized elastodynamics. The SDG formulation features a simple Bubnov-Galerkin projection that is stable and free of spurious oscillations for arbitrary polynomial order, $O(N)$ computational complexity on causal grids, and exact momentum balance on every spacetime element. We use unstructured spacetime meshes that support simultaneous grading in space and time. The SDG basis functions, which naturally accommodate nonconforming grids, facilitate refinement and coarsening. The mesh generation and finite element solution processes are interleaved on a patch-by-patch basis, so decisions to vary the polynomial order or to refine the grid can be made locally. An extended version of the Tent Pitcher algorithm provides a robust method for generating adaptive causal grids. We present results in 1D and 2D x time, emphasizing problems with shocks. This work was supported by NSF grant DMR 01-21695 and DOE subcontract B341494.

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