Preserving Positivity in Discontinuous Galerkin Methods via Truncation and Mass Aware Rescaling (TMAR)

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ABSTRACT

We describe a positivity preserving limiter for the advection of scalar tracers based on a discontinuous Galerkin (DG) finite element approximation. The positivity of an unknown tracer is preserved through a local and conservative limiter which utilizes a truncation and mass aware rescaling (TMAR) of the local approximating polynomial. The TMAR limiter is straightforward to implement and maintains the original high–order accuracy of the underlying DG scheme while adding a modest computational expense to each time step. We investigate the performance of the proposed method compared to an existing approach on several standard numerical tests, including a two-dimensional time dependent deformation flow. We observe that the proposed approach performs well in our tests and is particularly suited to higher degree polynomial truncations.

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