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SIAM Journal on Scientific Computing

Dear SISC Section Editor,

Please find enclosed our manuscript,

Jesse Chan, David C. Del Rey Fernandez, Mark H. Carpenter
Efficient entropy stable Gauss collocation methods,

which we would like to submit for publication as a research article in SISC.

The submitted manuscript investigates high order discontinuous Galerkin (DG) methods which satisfy a discrete entropy inequality. Entropy stable DG methods have been constructed on quadrilateral and hexahedral elements based on collocation at tensor product Gauss-Legendre-Lobatto rules, which contain quadrature points at element boundaries. Entropy stable DG methods have also been generalized to collocation schemes based on Gauss-Legendre rules, which do not contain quadrature points on element boundaries. However, the inter-element coupling terms for Gauss-Legendre collocation are non-compact, requiring coupling between lines of nodes on neighboring elements.

This work shows how to construct Gauss-Legendre collocation schemes with compact inter-element couplings on curvilinear quadrilateral and hexahedral meshes. We demonstrate the high order accuracy of the resulting schemes for smooth solutions, and show that, on non-Cartesian meshes, Gauss-Legendre collocation schemes achieve error levels which correspond to Gauss-Legendre-Lobatto collocation schemes of one degree higher. We conclude by illustrating the stability and robustness of the proposed scheme for a shock-vortex interaction problem and the inviscid Taylor-Green vortex.

We hope that the method and results discussed in this manuscript would appeal to the readership of SISC. All authors have approved the manuscript and agree with its submission, and we confirm that this manuscript has not been published elsewhere and is not under consideration by another journal. We look forward to hearing from you at your earliest convenience.

Best regards

Jesse Chan, David C. Del Rey
Fernandez, Mark H. Carpenter