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August 9, 2017

Dr Mikhail Shashkov
JCP Editor

Dear Dr Shashkov,

Please find enclosed the manuscript,

Jesse Chan

On discretely entropy conservative and entropy stable discontinuous Galerkin methods,

which we would like to submit for publication as a research paper in JCP.

The submitted manuscript describes the construction of high order discontinuous Galerkin (DG) methods which satisfy a discrete conservation or dissipation of entropy. Existing entropy conservative and entropy stable high order DG methods have been constructed based on diagonal norm summation-by-parts operators, or equivalently nodal collocation and under-integrated (lumped) mass matrices. This work extends the construction of entropy conservative and entropy stable schemes to non-diagonal mass matrices (or dense norm SBP operators) and over-integrated quadrature rules. Numerical experiments confirm the entropy conservation and high order accuracy of the new methods based on over-integrated quadrature, and comparisons are made with existing entropy stable methods based on under-integration.

In contrast to existing entropy conservative DG schemes, these new methods are formulated at the continuous level, and the proofs of entropy conservation rely only on properties of quadrature-based integration and L^2 projection. This continuous formulation also makes it possible to construct entropy conservative and entropy-stable methods using non-standard bases and approximation spaces.

We hope that the method and results discussed in this manuscript would appeal to the readership of JCP. The author confirms 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