Connections between the entropy projection and the robustness of entropy stable DG methods

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Entropy stable discontinuous Galerkin (DG) schemes provide improved robustness for high order accurate computational simulations of fluid flows with shocks or turbulent features. However, additional dissipation or shock capturing is still required for highly under-resolved flows [1, 2], especially in the presence of larger density variations. We observe numerically that entropy stable DG methods based on the "entropy projection" [3, 4] do not require additional shock capturing or dissipation to remain robust for problems with under-resolved small scale features (e.g., the Kelvin-Helmholtz, Rayleigh-Taylor, and Richtmeyer-Meshkov instabilities). We compare such schemes to entropy stable DG schemes which do not utilize the entropy projection, and investigate potential explanations for this observed difference in robustness.

References

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