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A NEW THERMODYNAMICALLY CONSISTENT FINITE ELEMENT METHOD FOR COMPRESSIBLE FLOWS

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We present a new finite element method for solving compressible flows. The proposed method is thermodynamically consistent in the sense that their solutions rigorously comply with the two laws of thermodynamics: for isolated systems they preserve the total energy and the entropy is non-decreasing. The formulation of such method is based on the well known SUPG scheme [1] and the ideas presented in [2]. Following the last, we express the evolution equation as a metriplectic system and enforce from their inception certain directionality and degeneracy conditions on the discrete vector fields.

We focus on the Euler equations, noting that the extension to the Navier Stokes equations for compressible fluids can be done following the same methodology. In the presentation we will describe the scheme, illustrate the properties of the integration procedure, and show numerical simulations that verify the qualitative features of the proposed method.

REFERENCES

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