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A gradient-robust well-balanced scheme for the compressible Navier-Stokes problem

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For incompressible flows gradient-robustness or, equivalently, pressure-robustness characterizes methods that compute discrete velocities that are independent of the pressure by improving the balance of irrotational forces in the momentum balance. Also for compressible flows (at low Mach numbers) the desired structural property remains that the divergence-free part of the velocity should not interact with irrotational gradient forces. This is also crucial for a well-balanced property in the sense that e.g. hydrostatic atmosphere-at-rest scenarios are preserved.

The talk presents such a scheme for the compressible Navier–Stokes equations that is based on a gradient-robust version of the Bernardi–Raugel finite element method and an upwinded finite volume method for the continuity equation. The method preserves the total mass constraint, positiveness of the density, and is provably convergent on unstructured grids (at least in the simplest isothermal case [1]).

REFERENCES

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