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Constrained minimization function recovery in Lagrangian hydrodynamics

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Traditional finite volume discretization of the Euler equations of gas dynamics (in Lagrangian coordinates) allow for straightforward computation of averaged (piecewise constant) values of the physical quantities involved (pressure, velocity, density and energy). In other parts of the computation however, certain derivatives (gradient and divergence) of the pressure and velocity are needed to close the overall discretization scheme. We study an approach based on minimizing TV (total variation) functionals subject to equality and/or inequality constraints to construct smooth function recovery of the pressure and velocity. The constraints have physical meaning; namely, positivity of pressure (or internal energy) and the recovered functions to preserve (approximately) their averages computed by the finite volume scheme. The overall scheme is illustrated with some preliminary numerical results.

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