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Application of the MOOD Technique to the Steady-State Euler Equations

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Abstract : The goal of the present work is to numerically study steady-state nonlinear hyperbolic equations in the context of the finite volume framework. We will consider the unidimensional Burgers' equation as the reference case for the scalar situation and the unidimensional Euler equations for the vectorial situation. We consider two approaches to solve the nonlinear equations: a time marching algorithm and a direct steady-state approach. We first develop the necessary and sufficient conditions to obtain the existence and unicity of the solution. We treat regular examples and solutions with a steady shock and to provide very-high-order finite volume approximations we implement a method based on the MOOD technology (Multi-dimensional Optimal Order Detection). The main ingredient consists in using an 'a posteriori' limiting strategy to eliminate non physical oscillations deriving from the Gibbs phenomenon while keeping a high accuracy for the smooth part.

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