The Positivity-Preserving Numerical Method for Compressible Multi-Media Flow

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In the numerical simulation of the multi-medium flow, the loss of positivity of the physically positive variables may lead to nonlinear instability or blow-ups of the algorithm. In this paper, we construct high order accurate scheme which preserve positivity of density and pressure in the simulation of compressible multi-media flows. The method is based on the positivity-preserving Runge-Kutta discontinuous Galerkin (RKDG) scheme for single medium flow and the real Ghost Fluid method (RGFM) for the treating of the interface. The obtained schemes are extended to the simulation of multi-media flow and the positivity-preserving limiters for pressure are modified for simplicity. The obtained limiters can keep the property of the original limiters and are cost effective. Furthermore, we develop a positivity preserving Riemann solver in RGFM interface treating method. Several numerical examples are given to test the robustness and efficiency of the algorithm. Numerical results show that the obtained method can maintain the positivity of pressure or density and can capture the discontinuities accurately.