A Non-Oscillatory Kinetic Scheme for Multi-Component Flows with the Equation of State for a Stiffened Gas

Song Jiang
Institute of Applied Physics and Computational Mathematics, China

We will extend the traditional kinetic scheme for ideal gases to the Euler equations with the equation of state for a multi-component stiffened gas. Based on a careful analysis of the oscillation mechanism of the traditional kinetic scheme across contact discontinuities, we propose a new non-oscillatory kinetic (NOK) scheme for multi-component stiffened gases. The basic idea in the construction is to use a flux splitting technique to construct numerical fluxes which do not depend on the concrete form of the equilibrium state. The new scheme not only can avoid spurious oscillations of the pressure and velocity near a material interface which are observed in the traditional kinetic schemes such as the kinetic flux vector splitting (KFVS) and BGK schemes, but also can deal with the stiffened gas equation of state. Moreover, we also carry out a careful analysis on the consistency condition, truncation error and positivity of the NOK scheme. A number of 1D- and 2D numerical tests are presented which demonstrate the accuracy and robustness of the new scheme in the simulation of problems with smooth, weak and strong shock wave regions. (joint-work with Yibing Chen)