

Time-implicit Gas-Kinetic Scheme

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In order to improve the computational efficiency of newly developed Gas-Kinetic Scheme (GKS) in engineering simulations, the time-implicit GKS has been constructed in combination with several common-used time-implicit techniques, such as LU-SGS, Point-Relaxation, GMRES and LU-SGS based on the numerical Jacobian matrix. Besides, the Crank-Nicholson method is adopted to achieve the second-order accurate in time. Numerical tests show that implicit schemes based on the numerical Jacobian matrix constructed by GKS show better performance than that based on macroscopic eigen decomposition due to the distinctive characteristics of GKS to describe particle movement at the mesoscopic level. The results also show that the time-implicit technique leads to a significant improvement of GKS scheme.

Keywords: Gas-kinetic scheme, time-implicit method, computational efficiency