The Efficiency of Gas-Kinetic BGK Scheme for Solving 2-D Compressible Inviscid Regular Shock Reflection Problem

Ong Jiunn Chit[*], Ashraf A. Omar[*], Megat M. Hamdan[#]
[*]Department of Aerospace Engineering
[#]Department of Mechanical & Manufacturing Engineering
Faculty of Engineering
University Putra Malaysia
43400, Serdang, Selangor, D.E.
Malaysia
E-mail: aao@eng.upm.edu.my

and

Waqar Asrar
Department of Mechanical Engineering
Faculty of Engineering
International Islamic University Malaysia
Jalan Gombak, 53100 Kuala Lumpur
Malaysia

Abstract

In this paper, the gas-kinetic BGK scheme is developed and tested for its ability in solving the two-dimensional compressible inviscid regular shock reflection problem. The BGK (Bhatnagar-Gross-Krook) scheme uses the collisional Boltzmann equation as the governing equation for flow evolutions. Second-order BGK scheme is also developed for flow simulation. This is achieved by means of reconstructing the initial data via MUSCL (Monotone Upstream-Centered Schemes for Conservation Laws) method. In addition, a multisage TVD (Total Variation Diminishing) Runge-Kutta method is employed for the time integration of the finite volume gas-kinetic scheme. A typical two-dimensional regular reflection of an oblique shock wave from a solid surface is chosen for testing the accuracy and robustness of the BGK scheme. The computational results are validated against the numerical results of Roe's scheme.