

Origins of one dimensional instability in stationary shock and slowly moving shock

ABSTRACT

Shock instabilities in the numerical sense include the carbuncle phenomenon and the slowly moving shocks. The carbuncle phenomenon is a term referred to the protruding formation at the stagnation region in addition to the continuous bow shock when simulating a high-speed flow over a blunt body. Most schemes formulated to cure this problem only focus on the dissipation methods without properly indulged into the real cause, which could also be the root problem for the slowly moving shock. Therefore, this paper attempted to find the source of the problem by firstly analyzing the governing equations starting from 1D case. After using perturbation mechanism on the conservative variables, several factors were found and one of them is caused by perturbation in density. Then, a dissipation was added to the RHS (right-hand side) of the continuity equation to remove the perturbation. This artificial dissipation has shown stable solutions for both stationay and slowly moving shock problems.

Keyword: Artificial dissipation; Carbuncle phenomenon; Shock anomaly; Slowly moving shock