

Shock wave diffraction calculations using very high order difference schemes

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Abstract:

Shock wave diffraction over convex walls have previously been investigated both experimentally and numerically [1, 2]. In this paper, we use numerical simulations to investigate the flow over a 90 degree sharp corner and multi-facet geometries.

The main focus is a two-facet geometry and flow with Reynolds number up to 10^6 . We analyze how very weak features such as shear layers and vortices can coexist together with strong features such as shocks.

To capture all these features we use a very high order difference schemes (4th, 6th, 8th order) [3, 4] together with a locally added amount of artificial dissipation [5] in the vicinity of shocks. The accuracy of the results is verified by comparison with experimental results.

Our technique with weak no-slip boundary conditions [3] provides us with a way to decide when the computation is resolved. For a coarse mesh we have a slip velocity at the wall, as the size of the mesh decreases, the slip velocity goes to zero. For a sufficiently fine mesh, the computation is well resolved.

With the maximum amount of computational resources available, we construct the finest mesh that we can manage in a reasonable time. Next we run on the highest Reynolds number that can be resolved (such that we have a vanishing no-slip velocity). This procedure optimize our computational resources for a given flow case.

References:

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