Applied

Mathematics

McGill
Applied Mathematics Seminar Series
Feb. 22nd, 2002

Dr. Nail K. Yamaleev, National Research Council, USA.

Title: Insight Into the Accuracy of Adaptive Grid Methods for Captured Shocks

Friday Feb 22,2002

Time: 2:30 pm (note time change!)

Room: Burnside 1205

Abstract: The accuracy of two grid adaptation strategies, grid redistribution and local grid refinement, is examined by solving the 2-D Euler equations for the supersonic steady flow around a cylinder. Second- and fourth-order linear finite difference shock-capturing schemes, based on the Lax-Friedrichs flux splitting, are used to discretize the governing equations. The grid refinement study shows that for the second-order scheme, neither grid adaptation strategy improves the numerical solution accuracy compared to that calculated on a uniform grid with the same number of grid points. For the fourth-order scheme, the dominant first-order error component is reduced by the grid adaptation, while the design-order error component drastically increases because of the grid nonuniformity. As a result, both grid adaptation techniques improve the numerical solution accuracy only on the coarsest mesh or on very fine grids that are seldom found in practical applications because of the computational cost involved. Similar error behavior has been obtained for the pressure integral across the shock. A simple analysis shows that both grid adaptation strategies are not without penalties in the numerical solution accuracy. Based on these results, a new grid adaptation criterion for captured shocks is proposed.

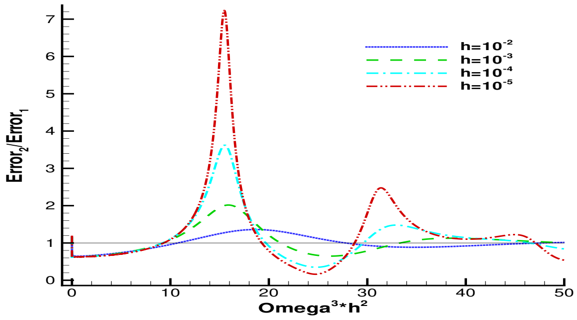

Figure 1: Ratio of the error obtained on the two-level locally refined grid to the error obtained on the corresponding background grid.