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稀疏非结构网格上的亚声速流高精度数值模拟

吕宏强，伍贻兆，周春华，田书玲

南京航空航天大学 航空宇航学院

High Resolution of Subsonic Flows on Coarse Grids

Lu Hongqiang, Wu Yizhao, Zhou Chunhua, Tian Shuling

College of Aerospace Engineering, Nanjing University of Aeronautics and Astronautics

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摘要 采用高阶间断有限元法在非结构网格上数值求解二维亚声速Euler方程。数值结果表明，尽管采用的非结构网格非常稀疏,但通过采用真实曲线物面边界和高阶的基函数仍可得到高精度的数值解。另外，对于超低速情况，方程无需经过任何特殊处理就可以得到收敛的数值解。由于采用牛顿一般最小余量法（Newton-GMRES）时通常需要较好的初始值，本文设计了一种阶谱循环过程来提高数值求解的鲁棒性。

关键词： 间断有限元　高阶格式　Euler方程　稀疏网格　Newton-GMRES

Abstract： A high-order discontinuous galerkin (DG) method is used to solve the 2-D Euler equations on unstructured grids. Numerical results indicate that highly accurate solutions can be obtained using high-order DG and real solid boundary conditions even on very coarse grids. Besides, preconditioning is not necessary when using high-order DG for very low Mach flows. Since a good initial guess is required when Newton-generalized minimal residual method (Newton-GMRES) is used, a hierarchic iteration procedure is developed to improve the robustness of relaxation.

Keywords： discontinuous galerkin　high-order scheme　Euler equations　coarse grids　Newton-GMRES

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