

Numerical Investigation of Incompressible Turbulent Flows by Method of Characteristics

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Abstract : A novel numerical approach for the steady incompressible turbulent flows is presented in this paper. The artificial compressibility method (ACM) is applied to the Reynolds Averaged Navier-Stokes (RANS) equations. A new Characteristic-Based Turbulent (CBT) scheme is developed for the convective fluxes. The well-known Spalart-Allmaras turbulence model is employed to check the effectiveness of this new scheme. Comparing the proposed scheme with previous studies, it is found that the present CBT scheme demonstrates accurate results, high stability and faster convergence. In addition, the local time stepping and implicit residual smoothing are applied as the convergence acceleration techniques. The turbulent flows past a backward facing step, circular cylinder, and NACA0012 hydrofoil are studied as benchmarks. Results compare favorably with those of other available schemes.

Keywords : incompressible turbulent flow, method of characteristics, finite volume, Spalart-Allmaras turbulence model

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