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Applocation of DNS/LES spectral element methods in turbulent flow simulations XU ZHANG, Inst. of Fluid Physics, China Academy of Engr. Physics; Postdoc research associate, Mathematics Dept., University of Wyoming, DAN STANESCU, Mathematics Dept., University of Wyoming, JONATHAN W. NAUGHTON, Mechanical Dept., University of Wyoming — This paper demonstrate applications of spectral element and large eddy simulation (LES) technique in turbulent flow simulations. The high-order discontinuous Galerkin(DG) spectral element method is applied to three-dimensional Navier- Stokes equations for spatial discretization. A local spectral discretization in terms of Legendre polynomials is used on each element of the hexahedra mesh, which allows for high-accurate simulations of turbulent flows. Discontinuities across the interfaces of the elements are resolved using a Riemann solver. An isoparametric representation of the geometry is implemented, with boundaries of the domain discretized to the same order of accuracy as the solution, and explicit low-storage Runge-Kutta methods are used for time integration. Large eddy simulation has proven to be a valuable technique for the calculation of turbulent flows. An element based filtering technique is used in conjunction with the standard Smagorinsky eddy viscosity model to estimate the effect of sub-grid scales stresses in this paper. The developed nonlinear model are also be added in the code. Simulations of compressible turbulent mixing layer and back-facing step are performed to evaluate the robust method. The results based on both DNS and large eddy simulations are presented in this paper.

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