Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

The direct Discontinuous Galerkin method for the compressible Navier-Stokes equations on arbitrary grids XIAOQUAN YANG, JIAN CHENG, North Carolina State University, TIEGANG LIU, Beihang University, HONG LUO, North Carolina State University — The direct discontinuous Galerkin (DDG) method based on a traditional discontinuous Galerkin (DG) formulation is extended and implemented for solving the compressible Navier-Stokes equations on arbitrary grids. Compared to the widely used second Bassi-Rebay (BR2) scheme for the discretization of diffusive fluxes, the DDG method has two attractive features: first, it is simple to implement as it is directly based on the weak form, and therefore there is no need for any local or global lifting operator; second, it can deliver comparable results, if not better than BR2 scheme, in a more efficient way with much less CPU time. Two approaches to perform the DDG flux for the Navier- Stokes equations are presented in this work, one is based on conservative variables, the other is based on primitive variables. In the implementation of the DDG method for arbitrary grid, the definition of mesh size plays a critical role as the formation of viscous flux explicitly depends on the geometry. A variety of test cases are presented to demonstrate the accuracy and efficiency of the DDG method for discretizing the viscous fluxes in the compressible Navier-Stokes equations on arbitrary grids.

Hong Luo
North Carolina State University

Date submitted: 31 Jul 2015 Electronic form version 1.4