Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

A Discontinuous Galerkin method for the compressible Navier-Stokes equations SREENIVAS VARADAN, ERIC JOHNSEN, University of Michigan — Turbulence developed from instabilities such as Rayleigh-Taylor or Richtmyer-Meshkov poses a challenging problem for numerical simulations. While shock capturing is necessary when shocks are present in the domain, one also needs to minimize dissipation in the smooth parts of the solution so that the high wave numbers are not damped by numerical viscosity. Our numerical experiments with 3-D isotropic turbulence at high turbulent Mach numbers indicate that hybrid methods, which only use shock capturing selectively based on the dilatation sensor of Ducros et al, have a clear advantage in terms of computational cost and bandwidth resolution but cannot sense contact discontinuities and material interfaces. Motivated by this, we propose a hybrid method for the simulation of the Rayleigh-Taylor instability based on a new sensor that detects contacts and material interfaces based on characteristic variables. The sensor has been tested on 1-D as well as multi-dimensional problems. We use the shock-capturing ability of the 5^{th} order WENO and the 6^{th} order central flux away from discontinuities. We discuss the performance and merits of using this method as well as results for the Rayleigh-Taylor instability.

Sreenivas Varadan
University of Michigan

Date submitted: 07 Nov 2011 Electronic form version 1.4