Abstract Submitted
for the DFD09 Meeting of
The American Physical Society

A divergence preserving Adaptive Mesh Refinement strategy for viscous incompressible flows[1] M. VANELLA, E. BALARAS, University of Maryland — Structured adaptive mesh refinement (S-AMR) concentrates computational resources (i.e. grid points) in high-gradient regions of the flow, while maintaining most of the desirable properties of structured Cartesian solvers. Whenever the computational grid is locally refined/derefined the flow variables in S-AMR calculations need to maintain certain conservation properties during restriction or prolongation operations. Restriction refers to the transfer of a flow variable from a grid at a fine level of refinement to an underlying grid at a coarser level, while prolongation is the data transfer in the inverse direction. Of particular interest in S- AMR applications in viscous incompressible flows are divergence-preserving prolongation operators of a vector field. When the mesh refinement-derefinement procedure is applied after the predictor step of the fractional step integration scheme, divergence preservation for prolongation is crucial to avoid spurious pressure oscillations and additional errors on the computed flow field. In this work we propose method for divergence-preserving prolongation applicable to nested grids that differ by a factor of two in terms of resolution. The accuracy of the method is evaluated on prototypical laminar flows, like the Taylor-Green vortex problem and flow around a cylinder.

[1]Research supported by the National Science Foundation and AFOSR.

Elias Balaras
University of Maryland

Date submitted: 11 Aug 2009 Electronic form version 1.4