Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

A Characteristic-Based Volume Penalization Method for Compressible Inviscid Flows in Complex Geometries[1] NURLYBEK KASIMOV, ERIC BROWN-DYMKOSKI, OLEG VASILYEV, University of Colorado at Boulder — This is the second of two talks on new volume penalization method for numerical simulations of compressible flows around solid obstacles of complex geometries. This approach overcomes two major limitations of Brinkman penalization – inability to model Neumann boundary conditions and shock reflection of solid boundaries. Boundary conditions on the fluxes are achieved through characteristic propagation into the thin layer inside of the obstacles. Inward pointing characteristics ensure non-physical solution inside the obstacle does not propagate out to the fluid. Dirichlet boundary conditions are enforced similarly to Brinkman penalization. Parameters defining the penalization terms are chosen so they act on a much faster timescale than the characteristic time scale of the flow. A principle advantage of this method is parameters provide a systematic means of controlling the error. New approach is general and applicable to a wide variety of flow regimes. This talk focuses on the application of the method to the Euler equations. The main difference compared to Navier-Stokes formulation is the handling of slip boundary conditions and the effect of the curvature in the momentum equation. Examples of supersonic compressible inviscid complex geometry flows are given and discussed.

[1]This work was supported by ONR MURI on Soil Blast Modeling.

Oleg Vasilyev
University of Colorado at Boulder

Date submitted: 01 Aug 2012 Electronic form version 1.4