Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

A Multi-Zone and Cut-Cell Method for High-Order Numerical Simulations of Compressible Flow Over Arbitrary Geometries PATRICK GREENE, JEFF ELDREDGE, XIAOLIN ZHONG, JOHN KIM, University of California, Los Angeles — The primary goal of our work is to study the effects of isolated roughness elements on the stability of hypersonic flow. To achieve this goal, we have been developing a high-order finite-difference compressible Navier-Stokes solver with the ability to simulate high-speed flow over arbitrary roughness geometries. A high-order cut-cell method is used to impose the roughness geometry on a simple Cartesian grid. The main idea behind the cut-cell method is to switch to a high-order non-uniform one-sided finite-difference stencil whenever the normally used stencil will cross a fluid-solid interface. In addition, a multi-zone method is implemented to provide more precise control over the placement of grid points compared to a single grid with clustering. The method allows a coarse grid to be placed over the entire domain with smaller high-resolution grids placed in regions where complex flow physics are expected. Results are presented for hypersonic flow over a cylindrical roughness on a flat plate. The roughness height is on the same order of magnitude as the boundary layer thickness. The results will be compared to recent experiments.

Patrick Greene
University of California, Los Angeles

Date submitted: 03 Aug 2012 Electronic form version 1.4