Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

The Space-Time CESE Method Applied to Viscous Flow Computations with High-Aspect Ratio Triangular or Tetrahedral Meshes CHAU-LYAN CHANG, NASA Langley Research Center, BALAJI VENKATACHARI, National Institute of Aerospace — Flow physics near the viscous wall is intrinsically anisotropic in nature, namely, the gradient along the wall normal direction is much larger than that along the other two orthogonal directions parallel to the surface. Accordingly, high aspect ratio meshes are employed near the viscous wall to capture the physics and maintain low grid count. While such arrangement works fine for structured-grid based methods with dimensional splitting that handles derivatives in each direction separately, similar treatments often lead to numerical instability for unstructured-mesh based methods when triangular or tetrahedral meshes are used. The non-splitting treatment of near-wall gradients for high-aspect ratio triangular or tetrahedral elements results in an ill-conditioned linear system of equations that is closely related to the numerical instability. Altering the side lengths of the near wall tetrahedrons in the gradient calculations would make the system less unstable but more dissipative. This research presents recent progress in applying numerical dissipation control in the space-time conservation element solution element (CESE) method to reduce or alleviate the above-mentioned instability while maintaining reasonable solution accuracy.

Chau-Lyan Chang
NASA Langley Research Center

Date submitted: 31 Jul 2016 Electronic form version 1.4