Simplified Formulation of the Flux Reconstruction Method for the Euler Equations
by
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Existing second-order finite volume schemes have had a strong history in predicting a large number of problems of interest in aeronautics, from attached flows over wings in cruise conditions to transonic flows; however, these schemes cannot reliably predict highly separated or vortex-dominated flows due to excessive numerical dissipation introduced through the spatial discretization. Higher-order methods offer the prospect of more accurate simulations of these currently intractable problems due to the reduction in such dissipation. The Aerospace Computing Laboratory is currently focused on the development of open-source software using high-order methods for CFD using the flux reconstruction method.

In this presentation, a new and simplified formulation of the high-order flux reconstruction scheme is outlined and its performance is investigated for linear and non-linear problems. An overview of the new formulation is given addressing its advantages over current flux reconstruction methodology, pertaining to both its conceptual simplicity as well as its impact on computational cost. An additional discussion on the linear stability of this scheme as well as its recovery of a specific class of energy-stable flux reconstruction schemes is also described. The results of several numerical experiments are presented to assess the relative performance of this scheme with existing flux reconstruction methods for both linear advection-diffusion problems and the Euler equations in two dimensions using quadrilateral elements.