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Application of gradient limiters for computation of viscous fluxes in an unstructured compressible flow solver J.P. STRODTBECK, University of Kentucky, K. WEBER, Rolls-Royce LLC, J.M. MCDONOUGH, University of Kentucky — HYDRA, an unstructured finite-volume CFD code used internally by Rolls-Royce LLC, evaluates viscous fluxes using a characteristic-based scheme in which the characteristic variables are modified with a pseudo-Laplacian smoothing introduced in the doctoral dissertation of Moinier (Oxford University, 1999). Since the pseudo-Laplacian scheme is inadequate for removing numerical oscillations in a variety of situations, a replacement scheme is proposed and implemented with characteristic variables approximated using a smoothed flux limiter based on a traditional minmod scheme. Formally, the method retains second-order accuracy except near oscillations. Convergence plots and comparisons with data demonstrate that the limiter technique provides improvement compared with baseline simulations. Convergence plot comparisons show improved mass flow conservation, removal of oscillations, and the capability of converging to machine zero without sacrificing overall accuracy. Besides this specific application to shock capturing in compressible flows, similar flux limiters may also be appropriate for use in implicit LES for incompressible flows where other limiters and/or filters are currently used in a similar pseudo-Laplacian manner, and also for compressible LES.

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