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Long-time stability effects of quadrature and artificial viscosity on nodal discontinuous Galerkin methods for gas dynamics[1] BRADFORD DURANT, JASON HACKL, SIVARAMAKRISHNAN BALACHANDAR, University of Florida — Nodal discontinuous Galerkin schemes present an attractive approach to robust high-order solution of the equations of fluid mechanics, but remain accompanied by subtle challenges in their consistent stabilization. The effect of quadrature choices (full mass matrix vs spectral elements), over-integration to manage aliasing errors, and explicit artificial viscosity on the numerical solution of a steady homentropic vortex are assessed over a wide range of resolutions and polynomial orders using quadrilateral elements. In both stagnant and advected vortices in periodic and non-periodic domains the need arises for explicit stabilization beyond the numerical surface fluxes of discontinuous Galerkin spectral elements. Artificial viscosity via the entropy viscosity method is assessed as a stabilizing mechanism. It is shown that the regularity of the artificial viscosity field is essential to its use for long-time stabilization of small-scale features in nodal discontinuous Galerkin solutions of the Euler equations of gas dynamics.

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