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Numerical Dissipation and Subgrid-scale Modeling for High-order DG Schemes DAVID FLAD, USRA, SCOTT MURMAN, NASA Ames Research Center — Using high-order discontinuous-Galerkin (DG) methods for large-eddy simulation (LES) continues to increase in popularity. The methods are often favored over high-order finite-difference schemes due to their geometrical flexibility, dense numerical operators, and minimal inter-processor communication. Often the methods are used with no explicit LES model added, relying on the inherent dissipation of the method to account for unresolved stresses, i.e. implicit LES. In order to obtain nonlinear stability polynomial de-aliasing ("exact" numerical quadrature) is frequently applied. In the current work, we analyze the quality of LES for a high-order implicit time discretization and various high-order spatial discretizations, with a focus on the different effects of inherent numerical dissipation of the schemes. Dissipation-free spatial operators are used to separate modeling terms and discretization errors. The suitability and limitation for high Reynolds number turbulent flows is analyzed and compared to results when adding an explicit subgrid-scale model, such as the Smagorinsky model. Results are presented for decaying homogeneous isotropic turbulence and wall-bounded channel flow.

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