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NUMERICAL INVESTIGATION OF SPLIT FORM NODAL DISCONTINUOUS GALERKIN SCHEMES FOR IMPLICIT LES OF A TURBULENT CHANNEL FLOW

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The implicit Large Eddy Simulation (iLES) approach based on the Discontinuous Galerkin (DG) method has received significant attention in recent years, due to the favorable dissipation and dispersion properties of the DG operator [1, 3]. Unfortunately, aliasing errors, caused by under-integration of the non-linear flux terms, lead to stabilitiy issues for under-resolved simulations and high-order approximations. A common stabilisation strategy is to increase the number of integration points to address the non-linearity of the flux, which is, therefore, denoted as over-integration or polynomial de-aliasing.

Gassner et al. proposed a promising alternative stabilisation technique for the DG scheme [2], which relies on the reformulation of the non-linear advection terms into split forms. It has been observed, that these split forms can stabilise the inviscid Taylor Green Vortex with high-order approximations, which are unstable with over-integration.

In this paper, we apply different split form DG schemes for iLES of a fully developed turbulent channel flow and investigate their robustness and accuracy for wall bounded flows. Furthermore, we compare these results to iLES with over-integrated high-order approximations in terms of statistical values and turbulence spectra. Finally, we show that the use of high-order split form DGSEM can significantly improve the results in comparison to low-order discretizations.

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