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Improving Shock-Free Compressible RANS Solvers for LES on Unstructured Meshes LAURENT GEORGES, PHILIPPE GEUZAINE, CENAERO, Avenue Jean Mermoz 30, 6041 Gosselies, Belgium — The objective of this contribution is to describe modifications required by standard RANS-like second-order discretizations on unstructured meshes to perform equally well for LES applications. The major issue is the effect of the numerical dissipation introduced to stabilize the discretization of the convective fluxes. It is well-known that this dissipation competes and often overwhelms the effect of the subgrid scale (SGS) model. An easy way to circumvent this problem is to resort to kinetic-energy conserving central schemes. Following the work by Mahesh and al. (JCP, 2004), we have developed and implemented an extension to compressible shock-free flows of their kinetic-energy conserving scheme (initially developed for incompressible flow solvers on unstructured meshes). Yet stable, this scheme can be prone to large truncation errors (as any low order schemes). We have performed simulations to investigate whether the SGS model can prevent the formation of spurious oscillations and whether these oscillations can be avoided without the use of an additional numerical dissipation such as high order upwinding. To highlight the aforementioned issues and the proposed solutions to resolve them, we have successfully performed simulations of the flow past a sphere (DNS at $Re = 300$ and a LES with the WALE model at $Re = 10{,}000$).

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