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Assessing the numerical dissipation rate and viscosity in CFD simulations of fluid flows[1] F.S. SCHRANNER, Technical University Munich, J.A. DOMARADZKI, University of Southern California, S. HICKEL, N.A. ADAMS, Technical University Munich — We describe a method for quantifying the effective numerical dissipation rate and the effective numerical viscosity in Computational Fluid Dynamics simulations. Differently from the previous approach that was formulated in spectral space, the proposed method is developed in a physical-space representation and allows for determining numerical dissipation rates and viscosities locally, i.e., at the individual cell level or for arbitrary subdomains of the computational domain. The method is self-contained using only results produced by the Navier-Stokes solver being investigated. Since no extraneous information is required, the method is suitable for a straightforward quantification of the numerical dissipation as a post-processing step. We demonstrate the method's capabilities on the example of implicit large-eddy simulations of three-dimensional Taylor-Green vortex flows that exhibit laminar, transitional, and turbulent flow behavior at different stages of time evolution. For validation, we compare the numerical dissipation rate obtained using this method with exact reference data obtained with an accurate, spectral-space approach.

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