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Assessment of accuracy of CFD simulations through quantification of a numerical dissipation rate[1] J.A. DOMARADZKI, G. SUN, X. XIANG, K.K. CHEN, University of Southern California — The accuracy of CFD simulations is typically assessed through a time consuming process of multiple runs and comparisons with available benchmark data. We propose that the accuracy can be assessed in the course of actual runs using a simpler method based on a numerical dissipation rate which is computed at each time step for arbitrary sub-domains using only information provided by the code in question (Schranner et al., 2015; Castiglioni and Domaradzki, 2015). Here, the method has been applied to analyze numerical simulation results obtained using OpenFOAM software for a flow around a sphere at Reynolds number of 1000. Different mesh resolutions were used in the simulations. For the coarsest mesh the ratio of the numerical dissipation to the viscous dissipation downstream of the sphere varies from 4.5% immediately behind the sphere to 22% further away. For the finest mesh this ratio varies from 0.4% behind the sphere to 6% further away. The large numerical dissipation in the former case is a direct indicator that the simulation results are inaccurate, e.g., the predicted Strouhal number is 16% lower than the benchmark. Low numerical dissipation in the latter case is an indicator of an acceptable accuracy, with the Strouhal number in the simulations matching the benchmark.

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