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Stability and Accuracy of Coupling Strategies in Hybrid LES/PDF Algorithms for Turbulent Reactive Flows PAVEL POPOV, HAIFENG WANG, STEPHEN POPE, Cornell University — Hybrid Large Eddy Simulation/Probability Density Function (LES/PDF) algorithms for turbulent reactive flow consist of two main components: a grid-based LES solver, and a Monte Carlo solver which approximates the composition PDF via an ensemble of Lagrangian particles. As a part of the interplay between these two codes, the PDF solver communicates to the LES solver the information which it needs in order to evaluate the filtered density field. Here, we assess two alternative strategies for implementing this coupling: either by directly passing density information from the PDF to the LES solver, or by evaluating density from an enthalpy field which is solved for by the LES code, and relaxed towards a consistent (up to numerical errors) PDF-based enthalpy field. We compare the stability of these two approaches, and their accuracy, defined as the level of consistency between a standalone LES and a coupled LES/PDF solution for a laboratory-scale jet flame, with flamelet chemistry modeling. The benefits of second-order time accuracy, relative to a first-order-accurate in time implementation, are examined, and different approaches for performing filtering of the PDF fields, which contain significant noise due to their stochastic nature, are evaluated.

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