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A Study of Passive-Scalar Mixing by Round Turbulent Jets using Inertial Large-Eddy Simulation with Multifractal SGS Modeling GREGORY BURTON, Lawrence Livermore National Laboratory — Large-eddy simulation of passive scalar mixing by a round incompressible turbulent jet is evaluated using the Inertial LES methodology with multifractal subgrid-scale modeling. The present work extends previous efforts in which the Inertial LES approach with multifractal modeling has been successfully applied to LES of forced and decaying homogeneous isotropic turbulence, as well as turbulent mixing of a passive scalar. The Inertial LES approach involves the direct calculation of both the inertial term $< u_i\, u_j >$ in the filtered incompressible Navier-Stokes equation, and the scalar flux term $< u_j\, \phi >$ in the filtered scalar advection-diffusion equation, rather than the use of traditional artificial viscosity closures. The approach requires models both for the subgrid velocity u^{sgs} and scalar fields ϕ^{sgs}, which are based on the multifractal structure of the enstrophy field and scalar dissipation field, respectively. The method produces high accuracy in the local spatial structure of the momentum, kinetic-energy and passive-scalar energy transfer fields between the resolved and subgrid scales, with correlations exceeding 0.99. The Inertial LES approach also has already produced accurate simulations of high-Schmidt number turbulent mixing. The presentation will focus on the evaluation of the Inertial LES approach in the significantly more complex case of scalar mixing by a turbulent round jet at both low and high Schmidt number.

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