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MODELING ONE AND TWO PASSIVE SCALAR MIXING IN TURBULENT JETS USING ONE-DIMENSIONAL TURBULENCE

Marten Klein[1,*] **and Heiko Schmidt**[2]

[1] Numerical Fluid and Gas Dynamics, Brandenburg University of Technology Cottbus-Senftenberg, Siemens-Halske-Ring 14, 03044 Cottbus, Germany, E-mail: marten.klein@b-tu.de

[2] Numerical Fluid and Gas Dynamics, Brandenburg University of Technology Cottbus-Senftenberg, Siemens-Halske-Ring 14, 03044 Cottbus, Germany, E-mail: heiko.schmidt@b-tu.de

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Accurate numerical representation of turbulent transport processes is crucial for many engineering applications but challenging due to the vast range of scales involved. For predictive numerical modeling, it is not only important to resolve the relevant scales but also to represent the transport processes physically correct (e.g. advective *versus* diffusive transport). We address these requirements by utilizing the map-based, stochastic one-dimensional turbulence (ODT) model [1]. ODT aims to represent all relevant scales of a turbulent flow along a notional line-of-sight. Molecular diffusion and (Lagrangian) mean advection are treated as deterministic processes, where as turbulent advection is modeled by a random sequence of measure-preserving mapping events that are sampled from a stochastic process.

In this study, we numerically investigate one and two passive scalar mixing in turbulent jets. Planar and round jet configurations are considered as canonical cases for spatially and temporally developing flows frequently encountered in chemical engineering (e.g. [2]). We utilize a fully-adaptive ODT formulation that has been extended recently to cylindrical configurations [3]. Our results suggest that ODT is able to capture low-order flow statistics to a reasonable degree. We show that the mixing of a single passive scalar is captured in terms of the mean, variance, and cross-stream turbulent transport and that it is resolved down to the Batchelor scale [4]. Preliminary results for two scalar mixing in a round jet suggest that the overall fidelity of the model is comparable to the planar case. We conclude that ODT provides an accurate, robust, and economic framework for forward-modeling of turbulent mixing problems.

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