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MAP-BASED STOCHASTIC METHODS FOR ACCURATE MODELING OF TURBULENT HEAT AND MASS TRANSFER 600

MARTEN KLEIN*, **DAVID O. LIGNELL**† **AND HEIKO SCHMIDT***

* Dept. of Numerical Fluid and Gas Dynamics
Brandenburg University of Technology (BTU) Cottbus-Senftenberg, Siemens-Halske-Ring 14,
D-03046 Cottbus, Germany
marten.klein@b-tu.de | heiko.schmidt@b-tu.de — www.b-tu.de/fg-stroemungsmodellierung/

† Dept. of Chemical Engineering
Brigham Young University (BYU), 330P Engineering Building, Provo, UT 84602, USA
davidlignell@byu.edu — https://ignite.byu.edu/

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ABSTRACT

Turbulent transport processes are ubiquitous in various applications ranging from the engineering to the geophysical context. The related turbulent flows are characterized by instationary and irregular fluid motions on a broad range of scales. Consequently, bulk properties, like the heat transfer across a layer of fluid or the maximum heat release in a reacting jet, crucially depend on the small-scale turbulent dynamics. In fact, some open issues in the quantitative understanding of the mass, momentum, and energy transport in these flows are related to intricate scale interactions. Therefore, reliable numerical simulations have to account for the multi-scale nature of turbulence, either by resolving it directly or by modeling it accurately. Both are challenging tasks.

The reliability and numerical feasibility of turbulent transport simulations is addressed here by state-of-the-art but sometimes not so widely known map-based stochastic modeling strategies. These models aim to resolve all relevant scales of a turbulent flow but within a dimensionally reduced setting. Turbulent advection is in turn modeled by a stochastic process that addresses the fundamental differences between turbulent and molecular-diffusive mixing processes.

With this Minisymposium we aim to present recent advances regarding the formulation and application of map-based stochastic turbulence models in the form of stand-alone tools and the coupling to numerical flow solvers. We want to bring together experts from the field in order to stimulate scientific exchange. These contributors will cover a broad range of applications, for example, unbounded and wall-bounded flows as well as flows with passive and active scalars. This may include thermal convection, chemically-reacting, and electrohydrodynamic flows.