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Modeling of Dissipation Element Statistics in Turbulent Non-Premixed Jet Flames[1] DOMINIK DENKER, ANTONIO ATTILI, JONAS BOSCHUNG, FABIAN HENNIG, HEINZ PITSCH, RWTH Aachen University —
The dissipation element (DE) analysis is a method for analyzing and compartmentalizing turbulent scalar fields. DEs can be described by two parameters, namely the Euclidean distance ℓ between their extremal points and the scalar difference in the respective points $\Delta\phi$. The joint probability density function (jPDF) of these two parameters $P(\Delta\phi, \ell)$ is expected to suffice for a statistical reconstruction of the scalar field. In addition, reacting scalars show a strong correlation with these DE parameters in both premixed and non-premixed flames. Normalized DE statistics show a remarkable invariance towards changes in Reynolds numbers. This feature of DE statistics was exploited in a Boltzmann-type evolution equation based model for the probability density function (PDF) of the distance between the extremal points $P(\ell)$ in isotropic turbulence. Later, this model was extended for the jPDF $P(\Delta\phi, \ell)$ and then adapted for the use in free shear flows. The effect of heat release on the scalar scales and DE statistics is investigated and an extended model for non-premixed jet flames is introduced, which accounts for the presence of chemical reactions. This new model is validated against a series of DNS of temporally evolving jet flames.

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Dominik Denker
RWTH Aachen University

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