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LC 2 Scalar Dissipation in Axisymmetric Jets WILLIAM
PITTS, *National Institute of Standards and Technology* CECILIA
RICHARDS, *Washington State University* MARK LEVENSON,
National Institute of Standards and Technology Scalar dissipation,
defined as twice the product of the molecular diffusion coefficient
and the local gradient of the mixture fraction taken as a dot prod-
uct with itself, characterizes molecular mixing rates in turbulent
flows and has a central role in turbulent combustion modeling.
Laser-induced Rayleigh light scattering combined with a unique
line camera has allowed real-time concentration measurements
along a line positioned in the radial direction of an axisymmetric
turbulent jet of propane flowing into air with sufficient resolution
to capture the small-scale fluctuations. Improving the effective
signal-to-noise ratio using wavelet analysis and invoking Taylor's
Hypothesis to determine the scalar dissipation in the axial direc-
tion allows the determination of the probability distribution func-
tions (pdfs) for scalar dissipation measurements in the axial-radial
plane. By assuming the fluctuations are isotropic and have a log
normal distribution, it is possible to obtain full pdfs for scalar
dissipation fluctuations in three dimensions from the planar re-
sults. The resulting pdfs allow the calculation of the average value
of the local scalar dissipation. The current results along with ex-
isting measurements in the literature are used to derive optimized
parameters for a similarity expression describing the variation of
the average scalar dissipation with downstream distance from the
jet exit, initial flow velocity, and density ratio.

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