Abstract Submitted
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Nonlinear scalar forcing based on a reaction analogy DON DANIEL, DANIEL LIVESCU, Los Alamos National Laboratory — We present a novel reaction analogy (RA) based forcing method for generating stationary passive scalar fields in incompressible turbulence. The new method can produce more general scalar PDFs (e.g. double-delta) than current methods, while ensuring that scalar fields remain bounded, unlike existent forcing methodologies that can potentially violate naturally existing bounds. Such features are useful for generating initial fields in non-premixed combustion or for studying non-Gaussian scalar turbulence. The RA method mathematically models hypothetical chemical reactions that convert reactants in a mixed state back into its pure unmixed components. Various types of chemical reactions are formulated and the corresponding mathematical expressions derived. For large values of the scalar dissipation rate, the method produces statistically steady double-delta scalar PDFs. Gaussian scalar statistics are recovered for small values of the scalar dissipation rate. In contrast, classical forcing methods consistently produce unimodal Gaussian scalar fields. The ability of the new method to produce fully developed scalar fields is discussed using 256^3, 512^3, and 1024^3 periodic box simulations.

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