Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Relationships between Physical and Fourier Space for Large-Eddy Simulation of Premixed Turbulence Combustion: Transition from Weak to Strong Vortices. YUAN XUAN, PAULO PAES, Pennsylvania State University, JAMES BRASSEUR, University of Colorado, Boulder — Large Eddy Simulation (LES) is a powerful formulation for turbulent reacting flows with tradeoff between complexity and resolution. LES assumes that all energy-dominant motions are well-resolved and forward cascade-dominant. But the application of this scale-based decomposition to reacting turbulent flows is not straightforward since dynamically important thin flame regions are mostly SFS. We aim to systematically refine understanding of the relationships between physical and scale space for LES of premixed turbulent combustion, beginning with reduced-physics simulations of the interaction between laminar premixed flame and single-scale vortex arrays with "eddy" strength systematically increased to create flame response from "wrinkled" to "pinched". We apply the Fourier description to these simulations using a newly developed procedure to remove the polluting content from discontinuities in inhomogeneous directions. Using wavelet-like filters we identify four characteristic structural features concurrently in physical/Fourier space, with relative significance estimated from the variance contained in the spectrally filtered fields. Different variables display distinct dominant structural features that undergo systematic transition from weak to strong eddy-flame interaction.

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Date submitted: 31 Jul 2017 Electronic form version 1.4