Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Relationships between Physical and Fourier Space for Large-Eddy Simulation of Premixed Turbulent Combustion: Multi-Dimensional Fourier Decomposition. PAULO PAES, The Pennsylvania State University, JAMES BRASSEUR, University of Colorado Boulder, YUAN XUAN, The Pennsylvania State University — Large Eddy Simulation (LES) is a powerful formulation to model turbulent reacting flows with tradeoffs between complexity and resolution. LES assumes that all energy-dominated turbulence motions are well-resolved and forward cascade-dominant so that modeled effects of Sub-Filter-Scale (SFS) motion are second order. However, the application of this scale-based decomposition to reacting turbulent flows is not straightforward since dynamically important kinetics within 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 interactions between single-scale vortex arrays and laminar premixed flames. We apply Fourier scale-based decomposition where interpretation in inhomogeneous directions is unclear and where periodic extension of the finite domain in those directions produce boundary discontinuities. We present a strategy to remove the pollution to the signal from these discontinuities with minimal modification of the original signal by systemically isolating their spectral content. The procedure is applied to a 2D vortex-flame interaction where we demonstrate 2D Fourier-physical space relationships in homogeneous and inhomogeneous directions. *Supported by AFSOR.*

Paulo Paes
The Pennsylvania State University

Date submitted: 01 Aug 2017 Electronic form version 1.4