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Dynamically-dominant Subfilter-scale content for application to LES of Turbulence-Flame Interactions in Premixed Turbulent Combustion JAMES BRASSEUR, Univ. Colorado Boulder, PAULO PAES, Gamma Technologies, YASH SHAH, YUAN XUAN, Penn State Univ. — In premixed turbulent combustion with strong turbulence, reaction-rate dynamics and heat release concentrate near thin front-like "reaction zone" regions with characteristic thickness at diffusion scales that are largely unresolved in large-eddy simulation (LES). Particularly problematic is the prediction of resolved-scale (RS) evolution of the third-order chemical nonlinearities associated with the local generation of species concentrations and thermal energy and second-order advective nonlinearities driven by space-time evolution of momentum within strong turbulence localized to sheet-like reaction zones that are largely unresolved by the LES grid. Using DNS of the interaction between a flame and arrays of rectilinear vortices, we describe the extraction of "dynamically dominant" subfilter-scale (SFS) structure near reaction zone sheets and the encapsulation of that structure within physics-based mathematical forms. We quantify the potential increase in accuracy in the application of these "basis functions" within the chemical and advective nonlinearities in the evolution of RS momentum, species concentration and thermal energy within the framework of large-eddy simulation. *Supported by AFOSR.*

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