Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

A wavelet-based scheme for coupling large-eddy simulation with the one-dimensional turbulence model YUQIANG FU, TAREK ECHEKKI, North Carolina State University — A wavelet-based scheme for coupling large-eddy simulation (LES) with the one-dimensional turbulence (ODT) model is developed. The LES-ODT approach is a multiscale framework for the simulation of turbulent reacting flows. It is based on the implementation of two solutions: 1) LES for continuity and momentum and 2) ODT for momentum and reactive scalars. Capturing large-scale transport for momentum and scalars is an integral component of the LES-ODT framework The objectives of the wavelet-based scheme are 1) to compound the large-scale velocity field from LES and ODT and 2) to dynamically determine a model parameter in ODT, which governs subgrid scale (SGS) stresses and scalar fluxes. The model is based on the compound wavelet matrix (CWM), which substitutes large-scale physics from LES onto the ODT solution, while maintaining the ODT residual SGS contribution intact. The ODT parameter, which is responsible for controlling the rate of SGS momentum and scalar transport in ODT is dynamically evaluated by comparing wavelet spectra from the ODT and LES solution around the filter cut-off scale. Different strategies are investigated to efficiently evaluate this parameter from an initial guess. The wavelet transform has unique features that enable an efficient and robust implementation of both compounding and ODT parameter estimation.

Yuqiang Fu
North Carolina State University

Date submitted: 05 Aug 2011 Electronic form version 1.4