Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Adaptive variable-fidelity wavelet-based eddy-capturing approaches for compressible turbulence[1] ERIC BROWN-DYMKOSKI, OLEG V. VASILYEV, University of Colorado Boulder — Multiresolution wavelet methods have been developed for efficient simulation of compressible turbulence. They rely upon a filter to identify dynamically important coherent flow structures and adapt the mesh to resolve them. The filter threshold parameter, which can be specified globally or locally, allows for a continuous tradeoff between computational cost and fidelity, ranging seamlessly between DNS and adaptive LES. There are two main approaches to specifying the adaptive threshold parameter. It can be imposed as a numerical error bound, or alternatively, derived from real-time flow phenomena to ensure correct simulation of desired turbulent physics. As LES relies on often imprecise model formulations that require a high-quality mesh, this variable-fidelity approach offers a further tool for improving simulation by targeting deficiencies and locally increasing the resolution. Simultaneous physical and numerical criteria, derived from compressible flow physics and the governing equations, are used to identify turbulent regions and evaluate the fidelity. Several benchmark cases are considered to demonstrate the ability to capture variable density and thermodynamic effects in compressible turbulence.

[1]This work was supported by NSF under grant No. CBET-1236505

Eric Brown-Dymkoski
University of Colorado Boulder

Date submitted: 01 Aug 2015 Electronic form version 1.4