Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Autonomic Closure for Large Eddy Simulation RYAN KING, PETER HAMLINGTON, University of Colorado at Boulder, WERNER J. A. DAHM, Arizona State University — A new autonomic subgrid-scale closure has been developed for large eddy simulation (LES). The approach poses a supervised learning problem that captures nonlinear, nonlocal, and nonequilibrium turbulence effects without specifying a predefined turbulence model. By solving a regularized optimization problem on test filter scale quantities, the autonomic approach identifies a nonparametric function that represents the best local relation between subgrid stresses and resolved state variables. The optimized function is then applied at the grid scale to determine unknown LES subgrid stresses by invoking scale similarity in the inertial range. *A priori* tests of the autonomic approach on homogeneous isotropic turbulence show that the new approach is amenable to powerful optimization and machine learning methods and is successful for a wide range of filter scales in the inertial range. In these *a priori* tests, the autonomic closure substantially improves upon the dynamic Smagorinsky model in capturing the instantaneous, statistical, and energy transfer properties of the subgrid stress field.

Ryan King
University of Colorado at Boulder

Date submitted: 01 Aug 2015 Electronic form version 1.4