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Autonomic Closure for Large Eddy Simulations RYAN KING, University of Colorado, Boulder, WERNER DAHM, Arizona State University, PETER HAMLINGTON, University of Colorado, Boulder — Motivated by the application of adjoint techniques for rapidly solving large optimization problems, a fundamentally new autonomic closure is presented that allows an essentially model-free, dynamic subgrid-scale closure for large eddy simulations (LES). The autonomic closure addresses nonlinear, nonlocal, and nonequilibrium turbulence effects and, in its most general form, is based on all possible tensorally-invariant, dimensionally-consistent relations between the local subgrid-stress tensor and resolved scale primitive variables. This introduces a large matrix of spatially and temporally varying coefficients that are optimized using a test filter approach and then applied at the LES filter scale by invoking scale similarity. The autonomic closure avoids the need to specify a model for the subgrid stresses, and instead allows the simulation by itself to determine the best local relation between the subgrid stresses and resolved state variables. A priori tests of this new autonomic closure approach are presented using data from direct numerical simulations of homogeneous isotropic and sheared turbulence, and application of the closure to practical simulations is discussed.

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