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Autonomous RANS/LES hybrid models with data-driven subclosures[1] GAVIN PORTWOOD, JUAN SAENZ, DANIEL LIVESCU, Los Alamos National Laboratory — We investigate the use of artificial neural networks (ANNs) to adapt classical Reynolds averaged Navier-Stokes (RANS) turbulence models for use in subgrid large-eddy simulation (LES) closures with the framework suggested by Perot & Gadebusch Phys. Fluids 19, 115105 (2007) . In this study, we consider the application of a slightly-modified $k - \epsilon$ model to simulate stationary and decaying homogeneous isotropic turbulence (HIT) at a range of grid resolutions. These modifications dynamically account for (I) grid resolution relative to resolved motions and (II) backscatter from unresolved to resolved scales. In this framework, a modified turbulent viscosity accounts for the former, and the latter is determined empirically as a multiplicative factor in the modeled turbulent stress tensor. We leverage artificial neural networks to establish a universal form of this backscattering factor as a function of filter size and resolved flow statistics via a-priori analysis of direct numerical simulations. We perform simulations of stationary and decaying HIT at multiple grid resolution with the model and show via *a-posteriori* analysis that the use of an ANN to model complex physical phenomena, such as local upscale transfer, is both attractive and practical.

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