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Minimum-dissipation models for large-eddy simulation[1] HYUNJI JANE BAE, Stanford University, WYBE ROZEMA, University of Groningen, Netherlands, PARVIZ MOIN, Stanford University, ROEL VERSTAPPEN, University of Groningen, Netherlands — Minimum-dissipation eddy-viscosity models are a class of subgrid scale models for LES that give the minimum eddy dissipation required to dissipate the energy of subgrid scales. The QR minimum-dissipation model [Verstappen, J. Sci. Comp., 2011] gives good results in simulations of decaying grid turbulence carried out on an isotropic grid. In particular, due to the minimum dissipation property of the model, the predicted energy spectra are in very good agreement with the DNS results up to the cut-off wave number unlike other methods. However, its results on anisotropic grids are often unsatisfactory because the model does not properly incorporate the grid anisotropy. We propose the anisotropic minimum-dissipation (AMD) model [Rozema et. al., submitted for publication, 2015], a minimum-dissipation model that generalizes the QR model to anisotropic grids. The AMD model is more cost effective than the dynamic Smagorinsky model, appropriately switches off in laminar and transitional flow on anisotropic grids, and its subgrid scale model is consistent with the theoretic subgrid tensor. Experiments show that the AMD model is as accurate as the dynamic Smagorinsky model and Vreman model in simulations of isotropic turbulence, temporal mixing layer, and turbulent channel flow.

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