Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

An assessment of LES models using the macroscopic forcing method[1] YASAMAN SHIRIAN, ALI MANI, Stanford Univ — In this work we introduce a new approach to assess the LES models based on contrasting the eddy diffusivity operators obtained from the DNS and LES flow fields. Our analysis is based on the expectation that the mean field momentum obtained from the LES must be the same as the filtered mean field momentum obtained from the DNS. Using the macroscopic forcing method (Park and Mani 2019), we project both the LES and DNS equations onto the RANS space and obtain the respective operators that govern the mean fields of both systems. In this presentation, we consider homogeneous isotropic turbulence as a canonical setting to assess the LES models. We show that while the standard Smagorinsky model performs reasonably at low-wavenumbers when assessed against this criterion, it is over-dissipative in the high-wavenumbers limit. Inspired by these results we introduce an alternative LES model and demonstrate its superior performance over the entire wavenumber spectrum.

[1]Boeing and DOE

Yasaman Shirian
Stanford Univ

Date submitted: 04 Aug 2020 Electronic form version 1.4