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A framework for Large Eddy Simulation (LES) based on spatiotemporal statistical information PRAKASH VEDULA, PETER ATTAR, ALLEN LABRYER, University of Oklahoma — We present a computational framework that will have the potential to not only improve the efficiency of computational predictions based on LES but will also be able to address a major drawback of many existing constructs of LES, namely inaccurate predictions of the underlying spatiotemporal structure. The latter drawback could be especially critical in prediction of tornado paths and jet-noise intensities. In our proposed framework, the relevant sub-grid scale stress models are constructed based on information that is consistent with the underlying spatiotemporal statistics. Unlike in many existing constructs of LES, the proposed sub-grid scale stress models include non-Markovian or memory terms whose origins can be explained based on the theory of optimal prediction. These optimal models for LES are studied using a one-dimensional Burgers equation with and without forcing. Results indicate that the proposed framework performs better than most existing frameworks of LES, by virtue of accurate predictions of spatiotemporal structure. The presence of coarse-grained temporal information in our sub-grid scale models also allows for faster simulations by allowing for larger time steps. Implications of these findings to more complicated turbulent flows will also be discussed.

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