Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

A new algebraic wall model for LES based on the momentum integral approach: formulation and sample applications[1] CHARLES MENEVEAU, XIANG YANG, JASIM SADIQUE, RAJAT MITTAL, Johns Hopkins University — Inspired by the momentum integral boundary layer method of von Karman and Pohlhausen (VKP), we propose an integral Wall Model for LES (iWMLES). To capture near wall physics without assuming equilibrium conditions, a velocity profile with various parameters is proposed instead of numerical integration of the boundary layer equation in the near-wall zone. Since numerical solution of boundary layer equations on a refined mesh near the wall is not required, we preserve the essential simplicity of equilibrium-type wall models with a cost that is independent of Reynolds number. Two sets of test cases are presented here: (1) Fully developed half channel flows with a smooth wall at various Reynolds numbers, and with a rough wall in which roughness elements are numerically not resolved. The code we use for these cases is a pseudo-spectral code for fully developed channel flow with a Lagrangian dynamic subgrid model. (2) LES of flow over surface mounted cubes in a fully developed half channel for which detailed experimental data are available. A finite difference LES code with sharp immersed boundary method and dynamic Vreman eddy-viscosity model is used in this application. Results show that iWMLES provides a practical and accurate wall model for predicting the mean wall stress in LES.

[1]This work is funded by ONR grant N00014-12-1-0582 (Dr. R. Joslin, program manager).

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Date submitted: 31 Jul 2014 Electronic form version 1.4