Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Generalized filtered boundary formulation for wall-bounded LES[1]

HENRY CHANG, AMITABH BHATTACHARYA, ROBERT MOSER, University of Texas at Austin — In previous work, a new treatment of wall boundary conditions for LES was developed, in which the wall was filtered along with the turbulence. In this filtered wall formulation, the computational domain is expanded beyond the wall, and a homogeneous or nearly homogeneous filter is applied in the expanded domain. In this case, the filtered Navier-Stokes equations include an extra term involving the wall tractions that arises from the filtering of the boundary. The wall tractions are modeled by requiring that no (or minimum) kinetic energy leaks out of the fluid domain. In the previous work, a global (Fourier) filter was employed, and the resulting LES simulations were in excellent agreement with filtered DNS data. In the current effort, we generalize this approach to local filters such as finite volume discretizations. This is important because finite volumes are a more generally applicable and more commonly used context for LES. Several generalizations are possible, the two most promising appear to be recasting in terms of a weak imposition of the boundary conditions, and recasting as an optimal estimation model. These approaches are evaluated in the context of an optimal LES formulation of the volumetric LES model, and compared to filtered DNS data.

[1]Support from AFOSR, grant F9550-07-1-0411, is gratefully acknowledged

Robert Moser
University of Texas at Austin

Date submitted: 03 Aug 2007 Electronic form version 1.4