Abstract Submitted for the DFD07 Meeting of The American Physical Society

Near-Wall Geometrical Analysis of the Resolved- and Subgrid-Scale Velocity and Temperature Fields DONALD BERGSTROM, University of Saskatchewan, Canada, BING-CHEN WANG, Defence R&D Canada - Suffield — In this research, we investigate wall anisotropic effects on the geometrical properties of the resolved and subgrid-scale (SGS) velocity and temperature fields based on both numerical and analytical approaches. Previous studies on geometrical statistics have primarily focused on either isothermal or isotropic turbulent flows; in this work, we extend the scope of research to investigate both isothermal and non-isothermal wall-bounded turbulent flows. We focus on studying the resolved enstrophy generation, local vortex stretching, and a variety of characteristic geometrical alignment patterns. The presence of the wall has a significant impact on the geometrical properties of the resolved velocity and temperature fields. Some probability density distributions associated with these alignment patterns converge to Dirac delta functions as the wall is approached. In addition, the relative rotation between the eigen-triad of the SGS stress tensor and that of the resolved strain rate tensor is studied using a novel parameterization method based on Euler's theorem. The proposed parameters are the natural invariants of the rotation matrix, and found to be very effective in assessing different SGS stress models in terms of their degree of nonlinearity and sensitivity to the near-wall anisotropy.

> Donald Bergstrom University of Saskatchewan, Canada

Date submitted: 02 Aug 2007

Electronic form version 1.4