

Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

An analysis of spatially varying turbulent Prandtl number in a flow with local acceleration and deceleration EUNBUM JUNG, WOOK LEE, SEONGWON KANG¹, Sogang Univ., Korea, GIANLUCA IACCARINO, Stanford Univ., USA — The turbulent Prandtl number (Pr_t) is an important parameter in turbulent flows used in many engineering models for heat transfer. In the present study, spatial variation of Pr_t in a wall-bounded turbulent flow is investigated using DNS. We derived a form of Pr_t applicable to a general flow configuration, using the least-square method in a manner consistent with the turbulent viscosity model in LES. For a flow subject to local acceleration and deceleration induced by the wall geometry, we performed a parametric study for the Reynolds number, Prandtl number and a geometric factor using DNS. A comparison of the data from DNS and RANS with a constant Pr_t indicates the potential of improved RANS predictions using the present variable Pr_t subject to the local flow field. Also, it is observed that the local pressure gradient has an important effect on the Pr_t field. From the flow statistics, a few flow variables showing higher correlations with Pr_t are identified. An elementary model for Pr_t is devised, and used for RANS prediction producing a more accurate prediction of the heat transfer rate.

¹Corresponding author

Eunbum Jung
Sogang Univ

Date submitted: 01 Aug 2015

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