

Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Influence of temperature-dependent fluid properties on heat transfer in turbulent channel flow ALFREDO SOLDATI, FRANCESCO ZONTA, CRISTIAN MARCHIOLI, Dept. Energy Technologies, University of Udine — Forced-convection heat transfer in turbulent liquid flows is parametrized by a correlation between the Nusselt number, Nu , the flow Reynolds number, Re , and the Prandtl number, Pr . Most of existing expressions for such $Nu = f(Re, Pr)$ correlation were developed under the assumption of negligible dependence of the thermo-physical properties of the liquid on temperature. This may be a bottleneck when system optimization is required. In this work we use pseudo-spectral direct numerical simulation to investigate the influence of temperature-dependent fluid properties on the overall turbulent heat transfer. In particular, we focus on turbulent channel flow of water, and we let viscosity vary with temperature at fixed Pr . Compared to the case of constant thermo-physical properties, it is observed that, already at low Re , temperature-dependent variations alter velocity profiles, and modify both the Nusselt number and the friction factor significantly (up to about 10 %).

Alfredo Soldati
University of Udine

Date submitted: 05 Aug 2010

Electronic form version 1.4