Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

The law-of-the-wall in mixed convection flow in a vertical channel[1] DUNCAN SUTHERLAND, Department of Mechanical Engineering, University of Melbourne Centre for Environmental Safety and Risk Engineering, Victoria University, Melbourne. , DANIEL CHUNG, ANDREW OOI, Department of Mechanical Engineering, University of Melbourne , ELIE BOU-ZEID, Civil and Environmental Engineering, Princeton University — Direct numerical simulations (DNS) of mixed convection in a plane vertical channel are conducted over a range of Richardson numbers. The direction of the buoyant forces are parallel and anti parallel to the direction of the imposed mean flow resulting in buoyancy-aided flow on the hot wall and buoyancy opposed flow on the cold wall. In the absence of buoyant forces the mean normal velocity profile is logarithmic and independent of the orientation of the wall. In the case of a horizontal channel, where buoyancy is orthogonal to the direction of mean flow, a correction to the log-law for the mean normal velocity is given by Moinin-Ohbukov similarity theory in terms of empirically determined universal functions of momentum and temperature. We attempt an an analysis of the law-of-the-wall for the aiding and opposing flows near the walls in a differentially heated vertical channel and develop analogous universal functions for temperature and momentum from the DNS data.

[1]Study supported by the Bushfire and Natural Hazards Cooperative Research Centre

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Date submitted: 03 Aug 2015 Electronic form version 1.4