Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Stability of optimal streaks in the buffer layer of a turbulent channel flow with variable viscosity ASHISH PATEL, Delft University of Technology, ENRICO RINALDI, Linne FLOW Centre, KTH Mechanics, RENE PECNIK, Delft University of Technology, PHILIPP SCHLATTER, SHERVIN BAGHERI, Linne FLOW Centre, KTH Mechanics — Direct Numerical Simulations (DNS) of turbulent channel flows with variable viscosity (Patel et al., 2015, PoF) show that low speed streaks in the buffer layer strengthen and are stabilized for increasing viscosity away from the wall, as they do not lift and tilt as intensely as in a constant property flow. The opposite holds for cases where viscosity decreases away from the wall. In this work, we investigate the above observation by studying the linear stability of the mean turbulent velocity profile obtained from DNS of variable viscosity flows. Examples of such studies for constant property turbulent flows include work of del Alamo & Jimnez, 2006, JFM and Pujals et al., 2009, PoF. The calculated optimal buffer layer streaks show larger transient energy growth for a case where the viscosity increases away from the wall. We further study the stability of the saturated optimal streaks by imposing a secondary sinuous perturbation and by following the nonlinear evolution of the structures in time. The present investigation will improve the understanding of the near-wall turbulence cycle for wall-bounded turbulent flows with viscosity gradients.

Ashish Patel
Delft University of Technology

Date submitted: 01 Aug 2016 Electronic form version 1.4