"Viscous versus inviscid exact coherent states in high Reynolds number wall flows"
B. Montemuro, J. Klewicki, C. White, and G. Chini
Thanks,
Alireza Ebadi

Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

A vortical step model of the turbulent boundary layer ALIREZA EBADI, JUAN CUEVAS, CHRISTOPHER WHITE, GREGORY CHINI, JOSEPH KLEWICKI, University of New Hampshire — Recent studies indicate that the turbulent boundary layer structure at high Reynolds number is composed of large uniform momentum zones (UMZs) segregated by countable narrow fissures of concentrated vorticity. A dynamic model that reproduces the fundamental elements of this UMZ structure by placing a few vortical fissures across the boundary layer in the wall-normal direction is presented. The number of fissures, their most probable wall-normal locations and their corresponding velocities follow scalings informed by analysis of the mean momentum equation in the inertial domain. Furthermore, an asymptotic length and velocity scaling is explored for the subinertial domain, and a conservation mechanism for momentum exchange throughout the turbulent boundary layer is enforced. An ensemble of statistically independent velocity profiles is created by letting the fissures move in the wall-normal direction, and exchange momentum as they do so. The numerical results shows the dynamic model is able to reproduce the main characteristics of the streamwise velocity field up to the fourth statistical moment.

Alireza Ebadi
University of New Hampshire

Date submitted: 31 Jul 2017 Electronic form version 1.4