Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Momentum transport in the wake of a finite-length thin flat plate[1]

ARMAN HEMMATI, DAVID H. WOOD, ROBERT J. MARTINUZZI, University of Calgary — A comparison of the wakes of thin flat plates with aspect ratios (AR) 1.0, 1.6, 2.0 and 3.2, normal to a uniform stream, are conducted based on Direct Numerical Simulations (DNS) at Re=1200. Typical anti-symmetric Karman shedding of high AR plates, AR¿2.0, is initiated by detachments at the plate corners. Shear layer detachment on the longer edges triggers shedding from the shorter edges. Thus, there is only a single shedding frequency detected in the wake. At lower AR, however, an interaction between adjacent shear layers occurs prior to detachment, which elongates the base vortex, i.e. from 1.56H for AR=3.2 to 2.69H for AR=1.6. This change of shedding mechanism has significant impact on wake structures and instantaneous pressure loads. The dominant shear layers on the longer sides appear to maintain the Karman shedding at higher AR. Karman shedding is intermittently interrupted for lower AR plates due to shear layer interactions, which increases the turbulence kinetic energy, production and dissipation rates and Reynolds stresses. To better understand dependence of the wake topology on AR, mean and fluctuating flow variables are evaluated at various locations along the chord. Moreover, comparisons to wakes of finite-height cylinders and circular plates are considered.

[1]This work is supported by AITF and NSERC fellowship grants.

Arman Hemmati
University of Calgary

Date submitted: 30 Jul 2015 Electronic form version 1.4