

Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Estimation of the global modes in the wake of a low-aspect-ratio pyramid¹ ZAHRA HOSSEINI, ROBERT J. MARTINUZZI, University of Calgary, Canada, BERND R. NOACK, PPRIME, France — A pressure sensor based estimation technique is proposed to extract the most energetic global modes in the turbulent wake of a wall-mounted square-based pyramid with apex angle of $\zeta = 60^\circ$ immersed partially in a thin turbulent boundary layer. A modified Extended Proper Orthogonal Decomposition (EPOD) technique is presented which exploits extracting the maximum pressure-velocity correlations for the optimal velocity estimation. The method is assessed based on the planar stereoscopic Particle Image Velocimetry data taken simultaneously with fluctuating pressure at the pyramid surface and the wall. The proposed modifications enable to recover significant dynamics that are otherwise lost in the EPOD estimation and greatly reduce the residual of the estimated coherent kinetic energy. The method will be used to estimate the three-dimensional coherent structures reconstructed from the dominant modes: mainly the fundamental harmonics associated to the periodic shedding and a slow-drift mode capturing the base flow modulations. Such three-dimensional description of the coherent structures helps to understand complex couplings between slow drift and harmonic fluctuations in tapered body wake.

¹This work is supported by the Natural Sciences and Engineering Research Council of Canada (NSERC).

Robert J. Martinuzzi
University of Calgary

Date submitted: 30 Jul 2014

Electronic form version 1.4