Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Characterizing cycle-to-cycle variations of the shedding cycle in the turbulent wake of a normal flat plate using generalized phase averages.[1] ROBERT MARTINUZZI, University of Calgary — Quasi-periodic vortex shedding in the turbulent wake of a thin-flat plate placed normal to a uniform stream at Reynolds number of 6700 is investigated based on Particle Image Velocimetry experiments. The wake structure and vortex formation are characterized using a generalized phase average (GPA), a refinement of the triple decomposition of Reynolds and Hussain (1970) incorporating elements of mean-field theory (Stuart, 1958). The resulting analysis highlights the importance of cycle-to-cycle variations in characterizing vortex formation, wake topology and the residual turbulent Reynolds Stresses. For example, it is shown that during high-amplitude cycles vorticity is strongly concentrated within the well-organized shed vortices, whereas during low-amplitude cycles the shed vortices are highly distorted resulting in significant modulation of the shedding frequency. It is found that high-amplitude cycles contribute more to the coherent Reynolds stress field while the low-amplitude cycles contribute to the residual stress field. It is further shown that traditional phase-averaging techniques lead to an over-estimation of the residual stress field.

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Date submitted: 01 Aug 2016 Electronic form version 1.4