Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Small-Scale Vortical Motions Effected by Aeroelastic Fluttering of a Self-Oscillating Reed in a Channel Flow SOURABH JHA, PABLO HIDALGO, ARI GLEZER, Georgia Inst of Tech — The formation, shedding, and advection of a hierarchy of small-scale vortical motions effected by an aeroelastically fluttering reed cantilevered across the span of a square channel are investigated experimentally at low (laminar or transitional) Reynolds numbers using high-resolution particle image velocimetry (PIV) and hot-wire anemometry. Formation and advection of vorticity concentrations along the surface of the reed are induced by concave/convex surface undulations associated with structural vibration modes of the reed. These modes lead to alternate time-periodic shedding of CW and CCW vortical structures having cross stream scales that are commensurate with the cross stream amplitude of the reed motion. The evolution of these vortices in the vicinity of the reed is strongly affected by interactions with the wall boundary layers that engender vorticity filaments spanning the entire height of the channel. These reciprocal interactions between the reed and the embossing channel flow leads to the evolution of small scale motions of decreasing scales that is characterized by enhanced dissipation and a distribution of spectral components that are reminiscent of a turbulent flow even at the low Reynolds number of the base flow. Supported by AFOSR.

Pablo Hidalgo
Georgia Inst of Tech

Date submitted: 01 Aug 2014 Electronic form version 1.4