Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

The influence of circulation distribution on LEV development for an impulsively-started, spanwise-flexible profile JAIME WONG, DAVID RIVAL, Queen's University — As a spanwise-flexible profile is accelerated from rest, the profile bends thereby causing a component of the free-stream flow to align with the spanwise direction. For the rapid accelerations typical in biological swimming and flying, accelerating a profile from rest will simultaneously result in the formation of a leading-edge vortex (LEV). The spanwise flow resulting from profile bending rearranges the distribution of circulation in the LEV along the span of the wing via vorticity convection, which does not occur in an otherwise equivalent rigid case. The effect of this circulation redistribution on LEV detachment and force history is difficult to separate from other flexibility effects, such as the varying shear-layer feeding rate and local acceleration. Therefore, the current study utilizes cyber-physical fluid dynamics (CPFD) to simulate an impulsively-started spanwise-flexible profile in the absence of spanwise flow. Nominally two-dimensional CPFD results are combined in a blade-element scheme that replicates the distributed load on a flexible profile. In this way, the effect of spanwise flow on LEV development and detachment and the resulting force histories can be isolated from other flexibility effects.

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Date submitted: 01 Aug 2014 Electronic form version 1.4