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Effects of Inflow Velocity Profile and Rotational Accelerations on LEV Formation for a Revolving Wing[1] JAMES PAULSON[2], University of Iowa, THIERRY JARDIN[3], Université de Toulouse, JAMES BUCHHOLZ[4], University of Iowa — An aspect ratio 10 rectangular wing is revolved in a cylindrical domain at 45 degree angle of incidence, and Reynolds number $Re = O(1000)$. Four cases are considered. Case A represents the physical problem in which the approach velocity varies linearly with distance from the axis of rotation, and Coriolis and centripetal accelerations are active in the non-inertial reference frame attached to the wing. Case B implements the same inflow but without rotational accelerations. In cases C and D, the rotational accelerations are the same as A and B, respectively; however, the inflow is uniform along the span. Each case exhibits a strikingly different behavior of the leading-edge vortex (LEV), demonstrating that inflow shear is an important factor governing LEV behavior, in addition to the rotational accelerations. A conical, attached vortex is observed only for case A. Vorticity transport analyses were conducted in chordwise planar control regions, at $z/C = 2.0$ (measured from the axis of rotation). In all cases, the leading-edge shear-layer vorticity flux and the diffusive flux from the wing surface provide opposing contributions to the measured circulation; however, they fluctuate significantly for all except case A.

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