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Vortex Formation Behind an Inclined 2-Dimensional Thin Flat Plate[1] MERAJ MOHEBI, DAVID H. WOOD, ROBERT J. MARTINUZZI, Univ of Calgary — Stereo Particle Image Velocimetry was used to measure the turbulent wake of a 2D flat plate inclined relative to a uniform stream as a heuristic model for airfoils and wind turbine blades at high incidence. Phase Averaging was performed to study the vortex dynamics and relate these to the force characteristics. Below 90°, immediately behind the plate, rounder and more organized trailing edge vortices form which possess higher circulation and are associated with higher Reynolds stresses than the counter-rotating, weaker and elongated leading edge vortices. The quasi-periodically shed vortices on the sides of the wake decay in strength at different rates to reach a circulation ratio of -1 within a distance less than 5 chords downstream of the plate for all angles. This equalization of vortex strength is related to an increase in turbulence diffusion, due to mostly-incoherent 3-dimensionality which progressively increases as the inclination angle is reduced, and convective transfer of vorticity between counter-rotating vortices. The wake experiences a sudden change in vortex formation mechanism at around 40°. At this angle, the frequency analysis on the signals of a pair of micro-pressure transducers in the wake also shows a discontinuity in the trends.

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