

Abstract Submitted
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Interaction of a perturbed trailing vortex with a wing GREGORY FISHMAN, DONALD ROCKWELL, Lehigh Univ — The interaction of a perturbed trailing vortex with a wing is explored in the context of formation flight. The incident vortex is generated from a leader wing at a fixed angle-of-attack, which is subjected to controlled oscillation in the vertical direction over a range of frequencies and at amplitudes an order of magnitude smaller than the chord of the wing. Particle image velocimetry is used to determine the flow structure of the perturbed vortex along the stationary follower wing. Two spanwise locations of vortex impingement are characterized: aligned with and inboard of the tip of the wing. Images of streamlines, vorticity and turbulent kinetic energy reveal the temporal and spatial evolution of the vortex structure. For the aligned interaction, the incident vortex induces a tip vortex of opposite signed vorticity on the wing thereby forming a dipole. For the inboard interaction, the incident vortex induces a vortex of same sign vorticity at the wing-tip and a shear layer of opposite sign across the wing surface. The upwash of the incident vortex promotes flow separation at the leading edge for both of these interactions; this separation gives rise to substantial levels of turbulent kinetic energy that persist downstream through the region of reattachment.

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