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The Influence of Spanwise Flow on Leading-Edge Vortex Growth
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It has been postulated that a spanwise component velocity through the core of a leading-edge vortex (LEV) can limit its growth and allow the LEV to remain attached to the wing. In the case of a delta wing, spanwise velocity is produced by wing sweep. However, in the case of flapping-wing flight, centripetal and Coriolis accelerations produce spanwise velocities which vary periodically. In order to understand the effect of various spanwise velocity profiles on LEV growth a simple analytical model for vortex growth has been developed. This model is based on the transport of vorticity-containing mass into the LEV through the leading-edge shear layer. By first neglecting spanwise effects, the model has been verified against a nominally two-dimensional plunging profile using Particle Image Velocimetry (PIV). With the addition of a spanwise transport of vorticity-containing mass, swept and flapping spanwise velocity profiles have been modeled and compared with three-dimensional, three-component velocity data collected using Particle Tracking Velocimetry.

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