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Lift generation on a flat plate with unsteady motions XI XIA, KAMRAN MOHSENI, University of Florida — The leading edge vortex (LEV) on an airfoil or wing has been considered to be one of the most important sources of lift enhancement according to several previous experimental and theoretical studies. In this work, the unsteady 2D potential flow theory is employed to model the flow field of a flat plate wing undergoing unsteady motions. A multi-vortices model is developed to model both the leading edge and trailing edge vortices (TEVs), which offers improved accuracy compared with using only single vortex at each separation location. The lift prediction is obtained by integrating the unsteady Blasius equation. It is found that the motion of vortices contributes significantly to the overall aerodynamic force on the flat plate. The results of the simulation are then compared with classical numerical, theoretical and experimental data for canonical unsteady flat plat problems. Good agreement with these data is observed. Moreover, these results suggests that the leading edge vortex shedding for small angles of attack should be modeled differently than that for large angles of attack. Finally, the results of vortex motion vs. lift indicate that the lift enhancement during the LEV "stabilization" above the wing is a combined effect of both the LEV and TEV motion.

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