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Lift Enhancement through the Modification of the Three-Dimensional Wake Vortex Dynamics KUNIHIKO TAIRA[1], TIM COLONIUS, California Institute of Technology, CLARENCE ROWLEY, Princeton University — Three-dimensional flow simulations are performed to understand the flow physics around low-aspect-ratio wings at low Reynolds numbers of 300 and 500. The aerodynamic characteristics of such wings and the dynamics and stability of the wake vortices are investigated. Of particular interest in the current research is the application of flow control to alter the vortex formation and evolution for lift enhancement at high angles of attack. Unlike separation control or circulation control, we modify the dynamics of the wake vortices to achieve lift increase. Steady downstream blowing at the trailing edge is found to be particularly effective. Such forcing allows for the tip vortices to be strengthened and generate stronger downward induced velocity upon the leading-edge vortices. Close roll-up of the leading-edge vortices results in the placement of the low-pressure core directly above the wing for lift enhancement, in some cases by double.

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