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Dynamics of separation over airfoils at low Reynolds number, Part II: Three-dimensional effects[1] KUNIHIKO TAIRA, TIM COLONIUS, WON TAE JOE, California Institute of Technology, CLARENCE ROWLEY, Princeton University — Experimental studies of low-aspect ratio flapping and rotating wings at low Reynolds number and high angle-of-attack have highlighted the stabilizing influence of three-dimensionality and rotation on the flow and in particular the leading-edge vortex. For purely translating wings, few measurements have been reported in the literature. We employ a new formulation of the immersed-boundary method to numerically investigate the dynamics and stability of three-dimensional separated flow behind a translating flat plate at low Reynolds number. The computations are validated by comparing forces and velocity fields with experimental measurements in an oil tow tank and a recirculating oil tunnel. Bifurcations from steady flow to vortex shedding are characterized as a function of aspect ratio, angle-of-attack, and Reynolds number. The influence of planform shape on the spanwise transport of vorticity is also investigated.

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