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Low Reynolds Number Wing Transients in Rotation and Translation[1] ANYA JONES, KRISTY SCHLUETER, University of Maryland — The unsteady aerodynamic forces and flow fields generated by a wing undergoing transient motions in both rotation and translation were investigated. An aspect ratio 2 flat plate wing at a 45 deg angle of attack was driven over 84 deg of rotation (3 chord-lengths of travel at 3/4 span) and 3 and 10 chord-lengths of translation in quiescent water at Reynolds numbers between 2,500 and 15,000. Flow visualization on the rotating wing revealed a leading edge vortex that lifted off of the wing surface, but remained in the vicinity of the wing for the duration of the wing stroke. A second spanwise vortex with strong axial flow was also observed. As the tip vortex grew, the leading edge vortex joined the tip vortex in a loop-like structure over the aft half of the wing. Near the leading edge, spanwise flow in the second vortex became entrained in the tip vortex near the corner of the wing. Unsteady force measurements revealed that lift coefficient increased through the constant-velocity portion of the wing stroke. Forces were compared for variations in wing acceleration and Reynolds number for both rotational and translational motions. The effect of tank blockage was investigated by repeating the experiments on multiple wings, varying the distance between the wing tip and tank wall.

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