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Unsteady maneuvering of a morphing wing. KAMLESH JOSHI, SAMIK BHATTACHARYA, University of Central Florida — The unsteady flow over a morphing flat-plate airfoil is investigated in this work. The unsteady flow is generated by accelerating the wing from rest and from one steady speed to a higher speed. The flat plate was towed in a water tank at an angle of attack of 30 degree with different acceleration numbers. The plate can be bent smoothly along the span with a flexion ratio of 0.7 and a flexion angle of 20 degree. In these tests, two different bending rates (BR), namely BR = 1s and 2s were implemented. The wing was towed from rest to Reynolds numbers of 10,000 and 20,000, and it was bent simultaneously along the span with zero phase difference between the forward towing motion and the bending motion. Instantaneous forces were measured with a six-dof force sensor, and the flow field was measured with the help of particle image velocimetry. It was found that spanwise bending has a considerable effect on the unsteady forces during acceleration. The vortex dynamics of the leading-edge-vortex was altered due to the variation of the shear layer velocity along the span which occurred due to the bending motion. In this work, we sought to quantify the effect of bending rate on the stability of the leading-edge vortex. We show that the gradual lifting of the tip vortex closer to the LEV, affects its growth. We also demonstrate that the spanwise bending action alters the added mass peak due to the inertial forces caused by the bending process. .

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