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Vorticity forces on a delta wing from the perspective of a force element theory CHENG-TA HSIEH, JIAN-JHIH LEE, CHIEN C. CHANG, CHIN-CHOU CHU, National Taiwan University — In this study, we consider various force contributions to an impulsively started delta wing from the perspective of a force element theory. A wing plate of aspect ratio AR is placed at the angle of attack (α) to the incident stream. We consider 3 aspect ratios of the delta wing: AR=1, 2, 4 and 3 angles of attack α=15°, 30° and 45°, while the Reynolds number Re is set to be the fixed 300. The force element theory enables us to examine forces exerted on the a delta wing credited to the individual flow structures, such as the leading-edge vortex (LEV), trailing edge vortex (TEV), as well as the contribution from the surface vorticity. It is widely known that flow over a delta wing is genuinely three-dimensional, and there is no two-dimensional analog. Here, we provide an insightful understanding of flow characteristics by relating the forces directly to the various sources of vorticity (wx, wy and wz) on or near the wing plate. The relative importance of the various vorticity contributions to the hydrodynamic forces is analyzed in terms of the aspect ratio and angle of attack.

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