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Turbulent Flow Over a Low-Camber Pitching Arc Wing MAJID MOLKI, Southern Illinois University Edwardsville — Aerodynamics of pitching airfoils and wings are of great importance to the design of air vehicles. This investigation presents the effect of camber on flow field and force coefficient for a pitching circular-arc airfoil. The wing considered in this study is a cambered plate of zero thickness which executes a linear pitch ramp, hold and return of 45 ° amplitude. The momentum equation is solved on a mesh that is attached to the wing and executes a pitching motion with the wing about a pivot point located at 0.25-chord or 0.50-chord distance from the leading edge. Turbulence is modeled by the $k-\omega$ SST model. Using the open-source software OpenFOAM, the conservation equations are solved on a dynamic mesh and the flow is resolved all the way to the wall ($y^+ \approx 1$). The computations are performed for Re = 40,000 with the reduced pitch rate equal to $K = c\dot{\theta}/2U_\infty = 0.2$. The results are presented for three wings, namely, a flat plate (zero camber) and wings of 4% and 10% camber. It is found that the flow has complex features such as leading-edge vortex, near-wake vortex pairs, clockwise and counter-clockwise vortices, and trailing-edge vortex. While vortices are formed over the flat plate, they are formed both over and under the cambered wing.

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