Abstract Submitted
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Vortex Generation by a Low-Camber Rotating Arc Wing MAJID MOLKI, Southern Illinois University Edwardsville — A rotating circular-arc wing is placed in a uniform turbulent flow to generate and study vortices. The momentum equation is modified for the non-inertial rotating reference frame attached to the wing. Turbulence is modeled by the $k-\omega$ SST model. Using the open-source software OpenFOAM, the conservation equations are solved on a dynamic mesh which rotates with the wing, and the flow is resolved all the way to the wall. The computations are performed for Re = 60,000 with rotation number ranging from Ro = 0 to 0.2. Lift and drag coefficients, contours of vorticity and streamlines, and pressure and vorticity over the wing are presented. The relationship between wall vorticity, pressure gradient, and vorticity flux is considered. This study indicates that rotation of the wing creates a dynamic situation that delays the stall to higher angles of attack and enhances the lift and drag coefficients. Depending on the orientation of the wing and rotational speed, a variety of flow patterns appear which include the leading-edge and rolling vortices, dynamic stall, vortex sheets, and stretching and bending of vortex sheets. The relationship between vorticity and pressure gradients are utilized to interpret and explain the flow features.

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