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Flow Structure on a Rotating Plate CEM OZEN, DONALD ROCKWELL, Lehigh University — The flow structure on a rotating (revolving) plate with an aspect ratio of one is considered for the case of steady plate rotation, well after the transient startup. Techniques of particle image velocimetry lead to patterns of vorticity in relation to the sectional streamline topology. Values of Reynolds number, attained by variation of the angular velocity of the plate, range from approximately 3,000 to 13,000. The observed patterns are relatively insensitive to Reynolds number. A well-defined leading-edge vortex, which remains in a stable position, is attainable over a wide range of effective angle of attack, up to 75 degrees. These quasi-two-dimensional features are intimately related to three-dimensional characteristics of the flow, which involves spanwise-oriented patterns of velocity that vary along the chord of the plate, as well as distinctive patterns in the vicinity of the root and the tip of the rotating plate. The flow structure on the corresponding plate undergoing steady, purely translational motion is directly compared with that along the rotating plate. The flow pattern is fundamentally altered in absence of rotation, with dominance of large-scale stall.

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