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Aerodynamics of Highly Cambered Circular Arcs With a Sharp Leading Edge at Low Reynolds Numbers JEAN-BAPTISTE SOUPPEZ, IGNAZIO MARIA VIOLA, University of Edinburgh — The flow around cambered circular arcs with a sharp leading edge is a paradigm that underpins a vast array of cambered thin wings. Yet, some key features of this flow condition, such as the impact of the leading-edge bubble on the boundary layer regime and trailing-edge separation, remain to be fully characterized. Here, particle image velocimetry was employed to portray the flow field around such geometries at incidences beyond the ideal angle of attack. The study revealed a combination of a critical Reynolds number and a critical angle of attack to trigger transition and to delay trailing edge separation. However, for the range of Reynolds number tested, from 54k to 220k, the leading-edge bubble was always turbulent. In fact, in the subcritical regime, relaminarisation occurred at the reattachment point. Conversely, in the post critical regime, the reattached boundary layer was turbulent all the way to trailing-edge separation. These findings reveal the critical effect of the leading-edge flow on the global flow field and associated forces experienced by thin, highly chambered wings with leading-edge separation. These results may further contribute to applications ranging from downwind yacht sails to micro aerial vehicles.

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