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Complex flows over simple wings. JOHN MCARTHUR, GEOFFREY SPEDDING, University of Southern California — As the chord Reynolds number (Re) of an airfoil section drops below 10^5, the global, averaged properties such as mean lift and drag, become strongly affected by the presence/absence of separation on portions of the upper surface. Such flows are difficult to measure and difficult to compute. As Re decreases further, the lift:drag polars become increasingly odd in shape and difficult to replicate. At the same time, the amount of reliable literature data drops, so the aerodynamic performance becomes, in many ways, quite unpredictable. Since many practical small-scale flying machines, be they fixed or flapping wing designs, operate in this Re regime, there is a clear need for an improved understanding of the basic performance based on the flow physics. An experimental program is described that characterizes the instantaneous flow fields and aerodynamic forces on two-dimensional and finite wings with various profile shapes. The objective is to provide a foundation for practical wing design at moderate Re, and to provide a basis for rigorous comparisons with emerging computational capabilities.

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