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AERODYNAMIC CHARACTERISTICS OF SEVEN SYMMETRICAL AIRFOIL SECTIONS THROUGH 180-DEGREE ANGLE OF ATTACK FOR USE IN AERODYNAMIC ANALYSIS OF VERTICAL AXIS WIND TURBINES

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ABSTRACT

When work began on the Darrieus vertical axis wind turbine (VAWT) program at Sandia National Laboratories, it was recognized that there was a paucity of symmetrical airfoil data needed to describe the aerodynamics of turbine blades. Curved-bladed Darrieus turbines operate at local Reynolds numbers (Re) and angles of attack (α) seldom encountered in aeronautical applications. This report describes (1) a wind tunnel test series conducted at moderate values of Re in which $0 \leq \alpha \leq 180°$ force and moment data were obtained for four symmetrical blade-candidate airfoil sections (NACA-0009, -0012, -0012H, and -0015), and (2) how an airfoil property synthesizer code can be used to extend the measured properties to arbitrary values of Re ($10^4 \leq Re \leq 10^7$) and to certain other section profiles (NACA-0018, -0021, -0025).