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Aerodynamic Characteristics of Bio-Inspired Wings with Spanwise Waviness in a Turbulent Freestream ALEXIA MARTINEZ-IBARRA, ROBERT FREEMAN, ISAAC CHOUTAPALLI, The University of Texas - Rio Grande Valley — An experimental study is performed to investigate the effect of varying amplitude and wavelength of leading-edge tubercles on the aerodynamic and flow field characteristics of a NACA-0010 airfoil in flow with high freestream turbulence intensity of 4%. The study involved three airfoils – a smooth leading-edge, and two with a tubercle amplitude of 6% of chord, and with eight and four tubercles (varying wavelength) over the span. The aspect ratio of all airfoils was 2.0. The freestream velocities ranged from 16 to 40 m/s, with the corresponding chord-based Reynolds number varying from 160K to 412K. The angle of attack was varied from -6 to 30 degrees. The results show that the two tubercled airfoils achieved little to marginal performance enhancement pre-stall. In the post-stall regime, the lift coefficient of the longer wavelength tubercle airfoil was only marginally higher than the baseline while the smaller wavelength airfoil evinced the highest lift and delayed stall in the range of Reynolds numbers tested. The flow field data obtained using PIV showed large amount of turbulent mixing at leading edge of the tubercle airfoils, thus delaying flow separation, and leading to delayed stall as compared to the baseline airfoil.

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