On the role of knurled rod flow control in the Aerodynamic Characteristics of LEP wind turbine blades

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ABSTRACT:

An experimental investigation has been conducted to assess the effect of knurled rod passive flow control device on the aerodynamic characteristics of novel bio-inspired Leading-Edge Protuberanced (LEP) wing section for wind turbine blades. Two different configurations of LEP featuring Peak and Trough incident angles at three different Reynolds number in the order of 10_4-10_5 were experimentally evaluated for a wide range of angle of attack ranging from $0° \leq \alpha \leq 90°$. Knurled rod of 3mm diameter were placed at two different chordwise locations over the suction side of the airfoil at 0.4 and 0.6C chordwise locations to understand its influence on the flow control over the variously modified LEP wings featuring peak and trough incidence angles. To the extent of the author, it is the first of its kind in the world to report the influence of the knurled rod on the aerodynamic characteristics of the peak and trough incident LEP wings. Results reveal that knurled rod passive flow control technique offers drag reduction at pre-stall angles and lift increment in post-stall angles. Aerodynamic force coefficients and surface pressure measurement detailing the underlying flow physics will be dealt in detail in full paper.

Keywords: Leading-edge protuberances (LEP), flow control, stall delay, time-series data, aerodynamic force coefficients, Wind tunnel testing, Surface pressure distribution