Abstract

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CFD Investigation of Transitional Separation Bubble Characteristics on NACA 63415 Airfoil at Low Reynolds Numbers

The wind turbine blades performance is strongly influenced by transitional separation bubbles, which may occur at low Reynolds numbers. Such a separation bubble is caused by a strong adverse pressure gradient, which makes the laminar boundary layer to separate from the curved airfoil surface. In the present paper, a CFD investigation is conducted to document the structure and behaviour of transitional separation bubbles at different Reynolds numbers. A two-dimensional incompressible Navier-Stokes equation and the transition SST turbulence model are used. The wind-tunnel tests of the NACA 63415 airfoil at Reynolds number $1 \times 10^6$ are used to compare with the time-averaged results of the present steady computations. The simulations were carried out at Reynolds number range of $150 \times 10^3$-$460 \times 10^3$ at different angle of attacks. This study presents the effects of angle of attack and Reynolds number on the separation characteristics and airfoil performance.