

Abstract

Ahmed S Shehata

Passive flow control for aerodynamic performance enhancement of airfoil with its application in Wells turbine—Under oscillating flow condition

In this work, the passive flow control method was applied to improve the performance of symmetrical airfoil section in the stall regime. In addition to the commonly used first law analysis, the present study utilized an entropy generation minimization method to examine the impact of the flow control method on the entropy generation characteristics around the turbine blade. This work is performed using a time-dependent CFD model of isolated NACA airfoil, which refers to the turbine blade, under sinusoidal flow boundary conditions, which emulates the actual operating conditions. Wells turbine is one of the most proper applications that can be applied by passive flow control method because it is subjected to early stall. Additionally, it consists of a number of blades that have a symmetrical airfoil section subject to the wave condition. It is deduced that with the use of passive flow control, torque coefficient of blade increases by more than 40% within stall regime and by more than 17% before the stall happens. A significantly delayed stall is also observed.