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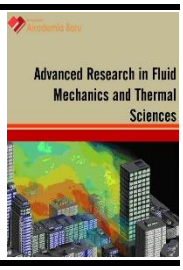

Experimental Study on the Effect of Boundary Layer Control on the Aerodynamics Characteristics of NACA 0021 Aerofoil

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ABSTRACT

Take-off and landing are the critical phases of an aircraft flight where there is a high demand of lift force at the lowest stalling speed of aircraft. Use of different techniques to increase the lift force during these phases of flight is one of the prime objectives in the design of an aircraft wing. Delaying and eliminating flow separation using boundary layer control (BLC) techniques will improve the aerodynamic characteristics of a wing. This work presents an experimental study on the effect of BLC on the aerodynamic characteristics of NACA 0021 aerofoil. Both the techniques of blowing and suction has been considered in this study. Model was built using composites and tested in a subsonic wind tunnel integrated with a compressor/vacuum pump setting for to control the boundary layer on the aerofoil. Firstly, the model with 20 pressure tappings was tested without BLC and the point of flow separation was noted. Later, the suction and blowing holes were made suitably in the model and equipped with a compressor/vacuum pump to control the boundary layer and study the effects of it on the performance of NACA 0021 aerofoil. As expected, the BLC by both the techniques show improvement in the maximum lift coefficient.

1. Introduction

The investigation of boundary layer control on an aerofoil has been ongoing since mid 20th century. The presence of the boundary layer has produced many design problems in all areas of aerodynamics. However, the most intensive investigations have been directed towards its effect upon the lift and drag of wing. Today, the application of this boundary layer control can be seen in every aircraft, including the military aircraft and civil transportation aircraft. The techniques have been developed to manipulate the boundary layer, either to increase the lift or decrease the drag. The better the manipulation, the better performance the aircraft would achieve.

Aircrafts are designed for the best aerodynamic efficiency which is attained by choosing aerofoils that results in least drag. The predominant drag component in an aircraft is the skin friction drag component which is directly related to the high shear stresses that results from turbulent boundary layers and its separation. This problem of turbulent boundary layer separation has been the subject

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