

Yasser Ahmed Mahmood, CONTROL OF SEPARATION FOR NACA 2412 AIRFOIL AT DIFFERENT ANGLES OF ATTACK USING AIR BLOWING, University Of Technology, Degree of Doctor, Prof. Dr. Jalal M. Jalil, Prof. Dr. Yousif A.H., 2009, 230page.

Abstract

The study of the separation control using the jet blowing based on the computation of Reynolds average Navier-Stokes equations is carried out in this work. A numerical model based on collocated Finite Volume method is developed to solve the governing equations on a body-fitted grid, to compute the performance of airfoil by using the blowing jet. Above of all, the performance of turbulence model is investigation. A revised $k-\omega$ model is proposed as the known turbulence models perform well in reproducing the flow of airfoil at pre-stall or stall angle of attack. The systematical investigation of the jet blowing is conducted on the NACA 2412 airfoil in the range of attack angle from 0° to 30° included up and beyond the stall angle at range of $Re=3.4 \times 10^5$ - 1.7×10^6 . The influence of some parameters associated with using jet blowing, such as its location, and the speed ratio (U_j/U) strength on the performance of the NACA 2412 airfoil has also been studied. The result shows that the jet blowing is effective in controlling the separation at $0.3c$ and $U_j/U=2$. The large separation region cannot be completely removed by the jet blowing. However, the flow structure can be regularized. The lift coefficient of the control airfoil is also increased with the angle of the attack and U_j/U increase.

The experimental results are obtained on airfoil NACA 2412 at $0.3c$ blowing and $U_j/U=2$. This model was tested in the low speed wind tunnel of the fluids laboratory (one of the laboratories in the mechanical engineering department at the University of Technology), the experimental results are been good agreement with the computational results.

Key words: Control, separation, Air blowing, NACA 2412, CFD.