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Numerical Simulation of the Effect of Single and Dual Synthetic Jet on Stall Phenomenon On NACA (National Advisory Committee for Aeronautics) GA(W)-2 Airfoil

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Abstract : Reducing the drag force increases the efficiency of the aircraft and its better performance. Flow control methods delay the phenomenon of flow separation and consequently reduce the reversed flow phenomenon in the separation region and enhance the performance of the lift force while decreasing the drag force and thus improving the aircraft efficiency. Flow control methods can be divided into active and passive types. The use of synthetic jets actuator (SJA) used in this study for NACA GA (W) -2 airfoil is one of the active flow control methods to prevent stall phenomenon on the airfoil. In this research, the relevant airfoil in different angles of attack with and without jets has been compared by OpenFOAM. Also, after achieving the proper SJA position on the airfoil suction surface, the simultaneous effect of two SJAs has been discussed. It was found to have the best effect at 12% chord (C), close to the airfoil's leading edge (LE). At 12% chord, SJA decreases the drag significantly with increasing lift, and also, the average lift increase was higher than other situations and was equal to 10.4%. The highest drag reduction was about 5% in SJA=0.25C. Then, due to the positive effects of SJA in the 12% and 25% chord regions, these regions were considered for applying dual jets in two post-stall angles of attack, i.e., 16° and 22°.

Keywords : active and passive flow control methods, computational fluid dynamics, flow separation, synthetic jet
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