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Influence of Micro-Blowing Technique Hole Parameters on Drag Reduction of Civil Aircraft Engine Nacelle: A Computational Study

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The numerical parametric analysis conducted to analyze the impact of Micro-Blowing Technique (MBT) wholeparameters is quite few at the present stage. The main aim of this research paper is to analyze the effect of micro blowing flow rate and its different hole-parameters on the skin friction drag reduction of an aircraft engine nacelle operating at cruise conditions. The primary tasks are focused to understand the behavior of the flow characteristics at the vicinity of the micro-porous holes by means of different types of MBT configurations. The interaction between main-stream flow and the micro-channel flow is numerically solved by using the Reynolds average Navier-Stokes equation and the k-omega SST is used to model the turbulent flow at the vicinity of the wall region. The hole-pattern is kept aligned in a single-row channel and the shape of the whole cross-section is kept straight to obtain an overall simplicity of the simulation model. The influences of the micro blowing technique are quite clearly seen from the simulation results, as there is a significant reduction in the velocity gradient between the solid engine nacelle surface and all the MBT configurations. The porous engine nacelle surface with zero blowing velocity is capable to reduce the skin friction drag by 7.045 % than of its solid surface, implying that the presence of the micro-porous holes possesses low effective surface roughness and it is an effective method to manipulate the turbulent boundary layer. The optimum skin friction drag reduction is observed when the geometrical characteristics of the holes possess small diameter and high aspect ratio.

Biography

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