عنوان مقاله:

Determination of Optimum Parameter Space of a Fluidic Thrust Vectoring System based on Coanda Effect Using Gradient-Based Optimization Technique

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خلاصه مقاله:

In the realm of aviation, jet propulsion systems serve to provide enhanced maneuverability and to make sure that the aircraft thrust is accurately and precisely regulated during take-off and landing operations. The movement of aerodynamic control surfaces (flaps, slats, elevators, ailerons, spoilers, wing attachments) determines the mobility of practically all aircraft types. Recognized as dependable components in the aviation world for take-off and landing tasks, these control surfaces are being replaced by fluidic thrust vectoring (FTV) systems, especially in small unmanned aerial vehicles (UAVs) and short or vertical take-off and landing aircraft. The FTV system is capable of directing thrust in any preferred direction without the need for any movable components. This paper numerically examines the FTV system by utilizing computational fluid dynamics (CFD) and an optimization technique based on gradients of the system components to understand the physics of the Coanda effect in FTV systems. This research employs gradient-based optimization for nozzle design in order to optimize the parameter space for different velocity ratios (VR) by calculating the moment around the upper Coanda surface, which is used to represent the jet deflection angle. In that context, four different Coanda surface-pintle pair designs for four different VRs are produced. The parameter space shows significant improvement in all four configurations, and results reveal that all output parameters successfully delay separation on the thrust vectoring system's upper Coanda surface. Finally, four optimum design suggestions are tested at various VRs, and the most efficient and proper design is recommended based on output parameters.

کلمات کلیدی:

Coanda effect, Fluidic thrust vectoring, Gradient-based optimization, Jet deflection, Thrust vectoring efficiency