

عنوان مقاله:

Sensitivity Analysis and Optimization of Delta Wing Design Parameters using CFD-Based Response Surface Method

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خلاصه مقاله:

This paper explores the effect of design variables on the objective functions of clipped delta wing with a modified double-wedge airfoil section based on parametric analysis and CFD-based optimization using response surface method. This type of wing is used in air-launch-to-orbit vehicles. The thickness, wing-span, tip chord, leading edge radius, front diagonal edge and rear diagonal edge lengths are defined as design variables and aerodynamic efficiency, drag and lift coefficients as objective functions. The analysis was performed at Mach 0.85 and 1.2 and for several angle of attack (AOA). The optimization process is performed by numerical stimulation of the flow around the wing at different Mach numbers and AOAs for the deformed geometry at each step including ۳۶۸ cases. Minimizing the drag force and maximizing both lift coefficient and aerodynamic efficiency have been selected as optimization goal. The evolutionary optimization technique of NSGA-II (Non-dominated Sorted Genetic Algorithm-II) in combination with the RSM has been used, which leads to distinct but very close candidates for each flight conditions. Defining the critical design point, it can be deduced the aerodynamic efficiency will be increased by ۵۰% compared with base wing model. Finally, it is shown that the best point for optimizing the air-launched vehicle equipped with delta wing in the .ascent trajectory, is the maximum angle of attack that occurs at Mach 1.2

کلمات کلیدی:

Delta wing, Air launch, to, orbit vehicle, aerodynamic efficiency, II Optimization, NSGA, Response surface methodology

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