

Maximization of the lift coefficient of airfoils equipped with active flow control devices

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Abstract

We state and solve an optimization problem of finding a shape of airfoils with a separation-free flow about them that are characterized by the external flow part extraction and propulsive jet ejection to achieve the maximum lift coefficient. An approach to this problem solution is based on the theory of inverse boundary-value problems of aerohydrodynamics. The initial problem with limitations is reduced by the penalty function method to a problem of unconditional optimization, the solution of which is obtained by the conjugate gradient method. The examples of constructing such airfoils with a separation-free flow about them are presented and the conclusions are made that it is rational to use the flow control devices to increase the lift coefficient. The results of numerical calculations are compared with data obtained in the Fluent CFD software. © Allerton Press, Inc., 2009.

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Keywords

Aerohydrodynamics, Airfoil, Inverse boundary-value problem, Optimization, Propulsive jet