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Investigation of mathematical models for estimating the scattering characteristics of hollow structures

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Today, one of the important and urgent tasks of the aerodynamics science is the study and optimization of aerodynamic characteristics of optimized profile shapes in a gas flow. This problem arises in the design of aircraft and various vessels and is associated with a rational choice of profile shape for a large number of different characteristics and, in particular, in terms of aerodynamic drag.

In this paper, consider methods for optimizing an axisymmetric aerodynamic profile in a stationary laminar inviscid gas flow at different angles of attack. The proposed method of solving such a problem of optimization and numerical study of aerodynamic characteristics of the described body in the flow is relevant due to the complexity of its solution, for example, by traditional methods based on the Navier-Stokes system of differential equations. Experimental methods are based on expensive and time-consuming tools that do not guarantee finding the optimum. Such a computing tool as Ansys Fluent is well suited for solving such problems of hydroaerodynamics and allows not only to speed up and reduce the cost of the computational experiment, but also to increase the efficiency of its implementation.

The article describes the process of finding the optimum, which reduces to minimizing the drag force of the previously described axisymmetric profile. A description is also given of the wing profile geometry parameterization and its analysis through the proposed software package.

The result of the numerical study is the obtained description of the aerodynamic characteristics of the optimized profile shape for various gas flow rates.

Keywords: Numerical simulation, computational experiment, aeronautical engineering, Ansys Fluent software system, airfoil, optimization process, drag minimization.

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