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REFERENCE DATA OF PRESSURE DISTRIBUTION ON THE SURFACES OF AIRFOILS HAVING THE NAMES BEGINNING WITH THE LETTER Z

Abstract: *The results of the computer calculation of air flow around the airfoils having the names beginning with the letter Z are presented in the article. The contours of pressure distribution on the surfaces of the airfoils at angles of attack of 0, 15 and -15 degrees in conditions of the subsonic airplane flight speed were obtained.*

Key words: *airfoil, angle of attack, pressure, surface.*

Language: *English*

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Introduction

Creating reference materials that determine the most accurate pressure distribution on the airfoil surfaces is an actual task of the airplane aerodynamics.

Materials and methods

The study of air flow around the airfoils was carried out in a two-dimensional formulation by means of the computer calculation in the *Comsol Multiphysics* program. The airfoils in the cross section were taken as objects of research [1-39]. In this work, the airfoils having the names beginning with the letter *Z* were adopted. Air flow around the airfoils was carried out at angles of attack (α) of 0, 15 and -15 degrees. Flight speed of the airplane in each case was subsonic. The airplane flight in the atmosphere was carried out under normal weather conditions. The geometric characteristics of the studied airfoils are presented in the Table 1. The geometric shapes of the airfoils in the cross section are presented in the Table 2.

Table 1. The geometric characteristics of the airfoils.

Airfoil name	Max. thickness	Max. camber	Leading edge radius	Trailing edge thickness
ZAGI10	9.94% at 30.0% of the chord	1.99% at 30.0% of the chord	0.7791%	0.0%
ZAGI12	11.9% at 30.0% of the chord	1.99% at 30.0% of the chord	0.9591%	0.0%

Table 2. The geometric shapes of the airfoils in the cross section.

Results and discussion

The calculated pressure contours on the surfaces of the airfoils at different angles of attack are presented in the Figs. 1-2. The calculated values on the scale can be represented as the basic values when comparing the pressure drop under conditions of changing the angle of attack of the airfoils.

2 airfoils of the ZAGI type were considered. The considered airfoils are asymmetrical.

The maximum thickness has the ZAGI12 airfoil. The minimum thickness is determined for the ZAGI10 airfoil. The camber values for each airfoil are the same. The largest leading edge radius of 0.9591% was noted for the ZAGI12 airfoil, and the minimum radius of 0.7791% was noted for the ZAGI10 airfoil. There is no thickening on the trailing edge for all airfoils.

Let us consider the aerodynamic characteristics of these airfoils.

The difference in the two considered airfoils is noted in the thickness and the leading edge radius. At the same time, the execution of maneuvers by the airplane leads to a decrease in the drag in conditions of increasing the thickness of the airfoil.

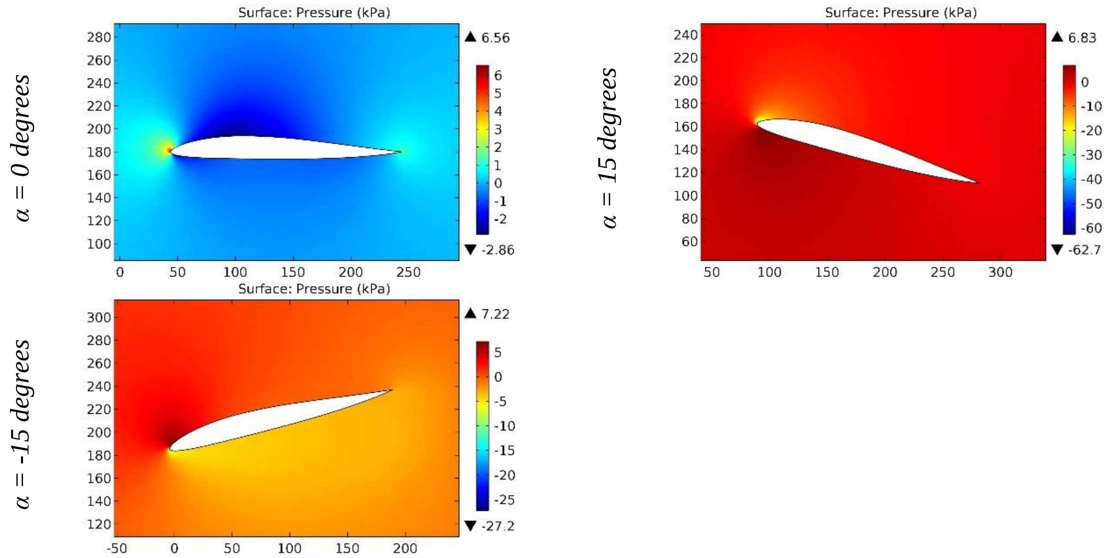

Figure 1. The pressure contours on the surfaces of the ZAGI10 airfoil.

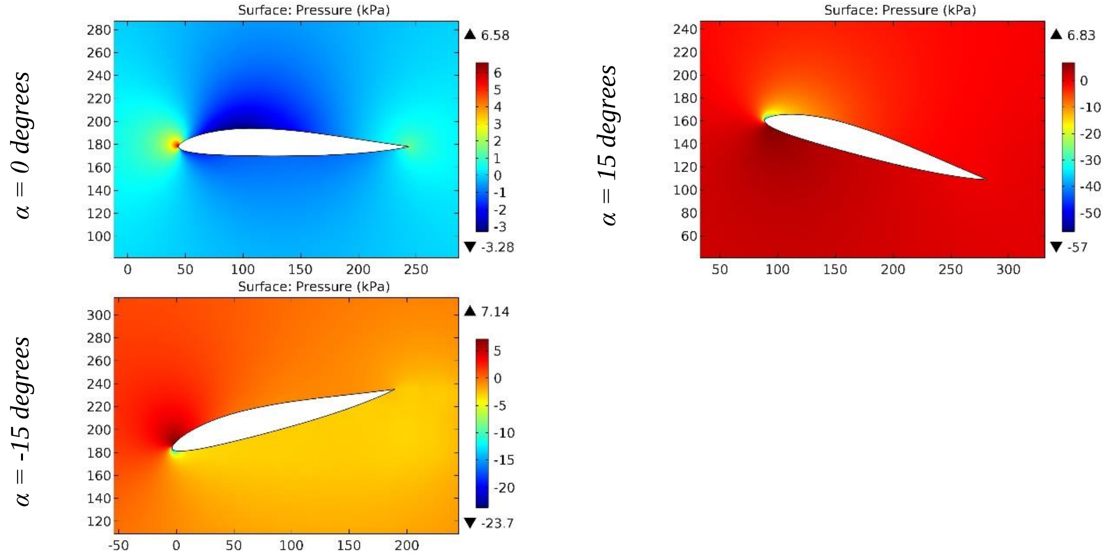

Figure 2. The pressure contours on the surfaces of the ZAGI12 airfoil.

As in most cases, the airplane climb is characterized by a higher drag on the leading edge. However, at zero angle of attack of the compared airfoil, a large leading edge area increases the drag of the airfoil, which is noted for ZAGI12.

Conclusion

Thus, the considered airfoils are characterized by a decrease in the drag at the leading edge during the airplane descent. An increase in the thickness and radius of the leading edge of the airfoil by 2% and 0.2%, respectively, led to a decrease in the effective pressure by about 5 kPa.

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