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

Abstract: *The results of the computer calculation of air flow around the airfoils having the names beginning with the letter V 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.

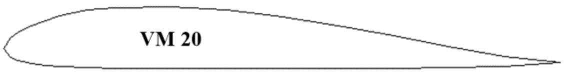
Materials and methods

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 [1-37]. In this work, the airfoils having the names beginning with the letter *V* 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
VL62-JAP	7.01% at 30.0% of the chord	6.84% at 40.0% of the chord	0.6927%	0.25%
VM 20	11.05% at 30.0% of the chord	5.53% at 30.0% of the chord	1.3142%	0.0%
Note: *VM 20 (France).*				

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.

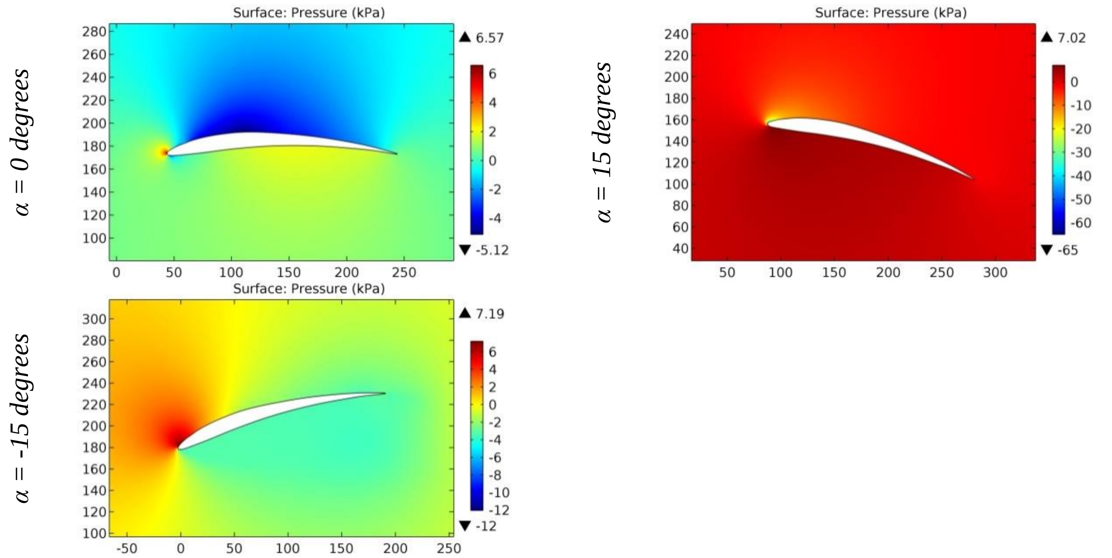


Figure 1. The pressure contours on the surfaces of the VL62-JAP airfoil.

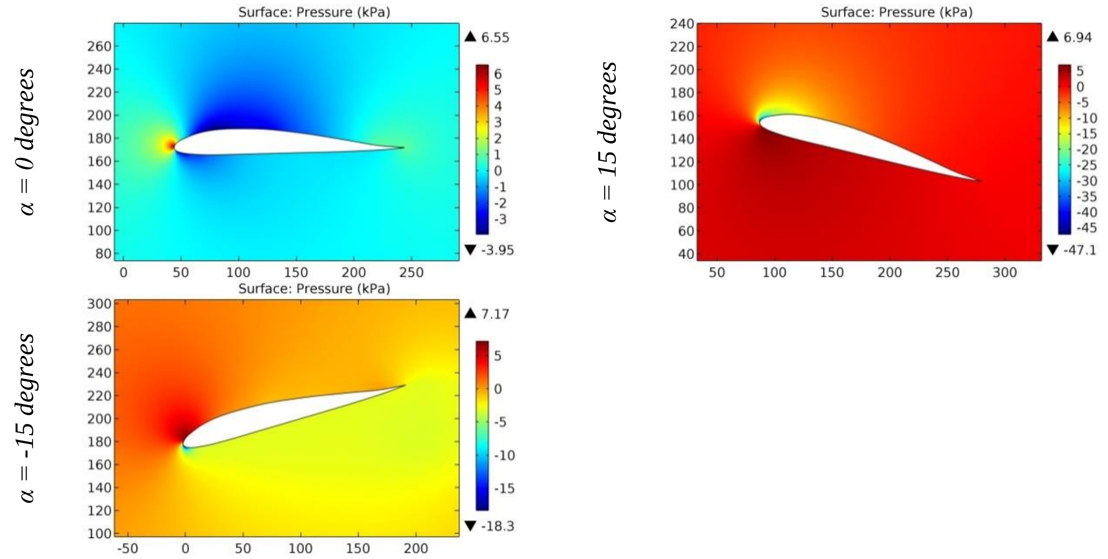


Figure 2. The pressure contours on the surfaces of the VM 20 airfoil.

The considered airfoils are asymmetrical. The maximum thickness is observed in the VM 20 airfoil, however, the maximum camber along the chord length is noted in the VL62-JAP airfoil. The ratio of the leading edge radii of the two airfoils is approximately 1:2. At the same time, it is noted that the VL62-JAP airfoil has a thickening on the trailing edge, and the VM 20 airfoil does not have it.

Let us compare the aerodynamic properties of the considered airfoils.

At an angle of attack of 0 degrees, a positive pressure arises on the leading edge of the airfoils, characterizing the drag, approximately the same in each case. During the climb of the airplane, the difference in pressures on the leading edge is significantly different: the drag on the leading edge of the VL62-JAP airfoil is higher than on the leading edge of the VM 20 airfoil. When the airplane descends, the pressure on the leading edge of the VL62-JAP airfoil is less than when the airplane descent with a wing having the VM 20 airfoil in the cross section. Thus, it can be concluded that the lifting force of the VL62-JAP airfoil when the airplane descent is greater than the lifting force of the VM 20 airfoil, which characterizes the best aerodynamic qualities of the first profile.

Conclusion

The large amount of camber of the VL62-JAP airfoil leads to an increase in drag on the leading edge, but also increases the lift of the airplane wing during descent. The large thickness of the VM 20 airfoil ensures a decrease in the drag coefficient during the climb of the airplane, but reduces the lift when the flight altitude decreases.

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