

# RESEARCH OF “PANSYM” SOFTWARE AERODYNAMIC COMPUTATION COMPARED WITH WIND TUNNEL TEST

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**Abstract.** The article deals with such aerodynamic problem as accuracy of computational fluid dynamics, particularly, panel-vortex method of the “Pansym” software. The subject of research is aerodynamic characteristics: lift, drag and longitudinal moment coefficients. The main aspects of the work are influence of vortex generators and deflected flaps on the panel-vortex method accuracy. The information of the research is useful for aerodynamic designers.

**Keywords.** Aerodynamics, “Pansym” software, vortex generator, flap.

## 1 Introduction

Aerodynamic characteristics analysis for computational model and appropriate wind tunnel model was performed. Models of Ukrainian light aircraft “A-20” were utilized. Experimental data acquisition was performed in National Aviation University. Both models were tested in two configurations: with flaps deflected by 10 degrees (take-off configuration) and with non-deflected flaps (cruise configuration). Calculation adequacy with diffuser vortex generators system on upper wing surface for both configurations was checked.

## 2 Lift coefficient estimation

Based on performed comparison we can declare that “Pansym” software is acceptable for definition some aerodynamic characteristics of the aircraft without diffuser vortex generators system. For example, lift coefficient graph in the range of flight angles of attack (linear part) shows good agreement with experimental results.  $C_Y$ -graph for model equipped with VG system and with non-deflected flaps also confirmed by wind tunnel test, but only because vortex generators have no significant effect on this parameter. When they actually have (as can be seen for model with deflected flaps), “Pansym” software is unable to display it.

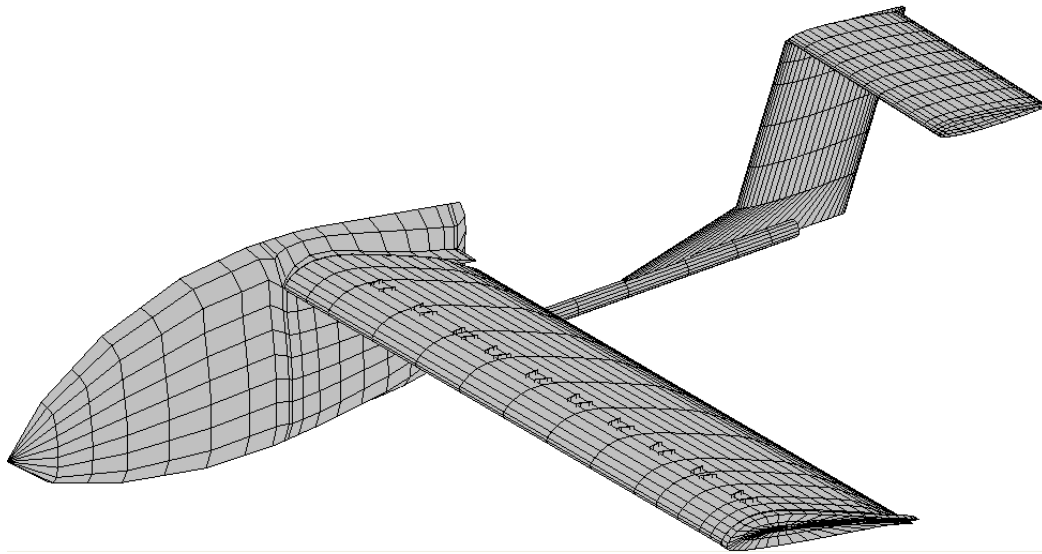


Fig. 1. “A-20” aircraft model with vortex generators and deflected flap in “Pansym” software

### 3 Drag coefficient estimation

Calculated drag coefficient graph has systematic error, i.e. underpredicts drag value on about 0.015. The possible cause could be fuselage pressure drag, which calculation with panel-vortex method is rough, and also value of experimental model parasitic drag larger than predicted. Error-correcting Pansym results may be used for separation-free drag estimation, i.e. for flight angles of attack.

### 4 Conclusion

“Pansym” calculations can’t be utilized in next situations:

- for angles of attack out of the linear part of lift coefficient graph;
- for estimation of typical diffuser vortex generators effect on functions  $C_Y(\alpha)$ ,  $C_X(\alpha)$ ,  $m_Z(C_Y)$  even for flight angles of attack;
- for estimation of moment characteristics  $m_Z(\alpha)$  and  $m_Z(C_Y)$  with and without VG system in any configuration.

It should be noticed that aerodynamic performance calculations  $C_Y(\alpha)$ ,  $C_X(\alpha)$  are confirmed by wind tunnel test better in cruise configuration (with non-deflected flaps) than in take-off configuration.

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