COMPARISON BETWEEN THE DRAG POLAR CURVES USING ANALYTICAL AND NUMERICAL METHODS IN CONTROLLED RADIO AIRPLANE

ANDERSON P. ALMEIDA*, LUIZ M. PEREIRA†, CAIO CÉSAR G. SANTOS§, LEONARDO S. MACHADO¶

*Universidade Federal do Vale do São Francisco (UNIVASF)
Laboratory of Computational Fluid Dynamics, Juazeiro, Bahia, Brazil
anderson2999@gmail.com

†Universidade Federal do Vale do São Francisco (UNIVASF)
Laboratory of Computational Fluid Dynamics, Juazeiro, Bahia, Brazil
luiz.mariano@univasf.edu.br

§Universidade Federal do Vale do São Francisco (UNIVASF)
Laboratory of Computational Fluid Dynamics, Juazeiro, Bahia, Brazil
ciao_egs@hotmail.com

¶Universidade Federal do Vale do São Francisco (UNIVASF)
Laboratory of Computational Fluid Dynamics, Juazeiro, Bahia, Brazil
leosampaio_fsa@hotmail.com

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ABSTRACT

This paper aims to compare the drag polar curves between numerical and analytical methods of a controlled radio airplane and identify it result at the maximum takeoff weight. It’s presented a theory about Fluid Mechanics and Aerodynamics, beyond the boundary conditions and the software used in the CDF simulations. It was observed by the results that the two methods resulted in similar drag polar curves, but the curve obtained in the CFD simulations resulted values much closer in practice for small and high angles of attack. It was obtained a relative error between the $C_D$ and $C_L$ using the two methods below 10% for much of the speed range, beyond a relative error of the 3.5% in the prediction of the maximum takeoff weight using the numerical method and 7.9% using the analytical method, in comparison to the maximum takeoff weight obtained in flight tests. The analytical method can be used in the preliminary design, while the numerical method can be used to predict with more accuracy the $C_D$ and $C_L$ values and finally to result in a better prediction of the airplane performance than analytical method in conditions of the takeoff, landing and straight flight.