Labor Windkanal/Strömungsmesstechnik

OSTBAYERISCHE TECHNISCHE HOCHSCHULE REGENSBURG

Aerodynamic optimization of a new type wing-fuselage combination of a wind tunnel model

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https://hps.hs-regensburg.de/las39261/

1. Outline

This bachelor thesis deals with the aerodynamic optimization of the aerodynamic wing-fuselage interaction, where drag is caused by interferences, amounting to major parts of the overall wind resistance. Optimizing this intersection should lead to a better flight performance, especially for glider-pilots who rely heavily on good aerodynamic properties allowing them to glide over long distances. But improved aerodynamic properties are also a benefit for motorized aircrafts, resulting in lower fuel consumption and more range.

Fig. 1: Test rig in the open test section in the Regensburger Windtunnel at OTH Regensburg

2. Improved LabView® application

The user interface of the LabView® application has been improved. Several curves of previous measurements can be loaded for comparison. Custom sets of angles of attack can be loaded as .csv-files, too. In addition to that, oscillations occurring on the model can now be determined.

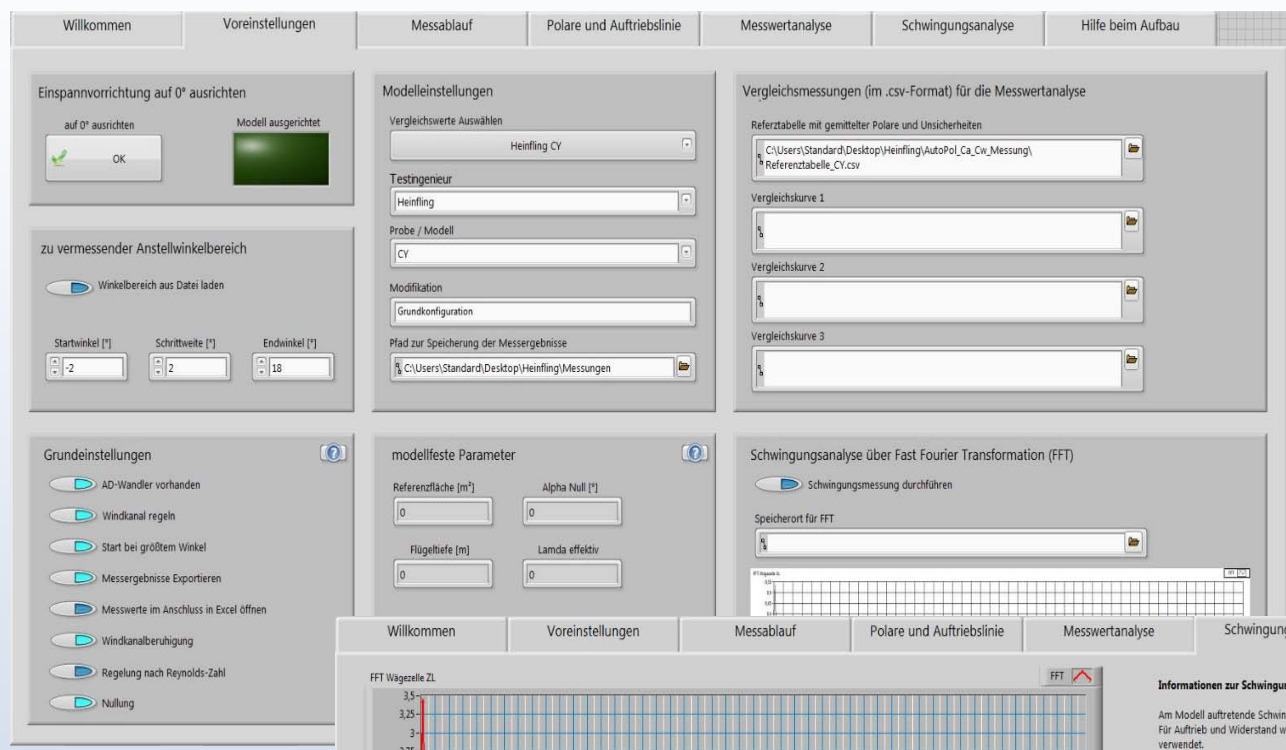

Fig. 2: Panel of the preferences which can be made

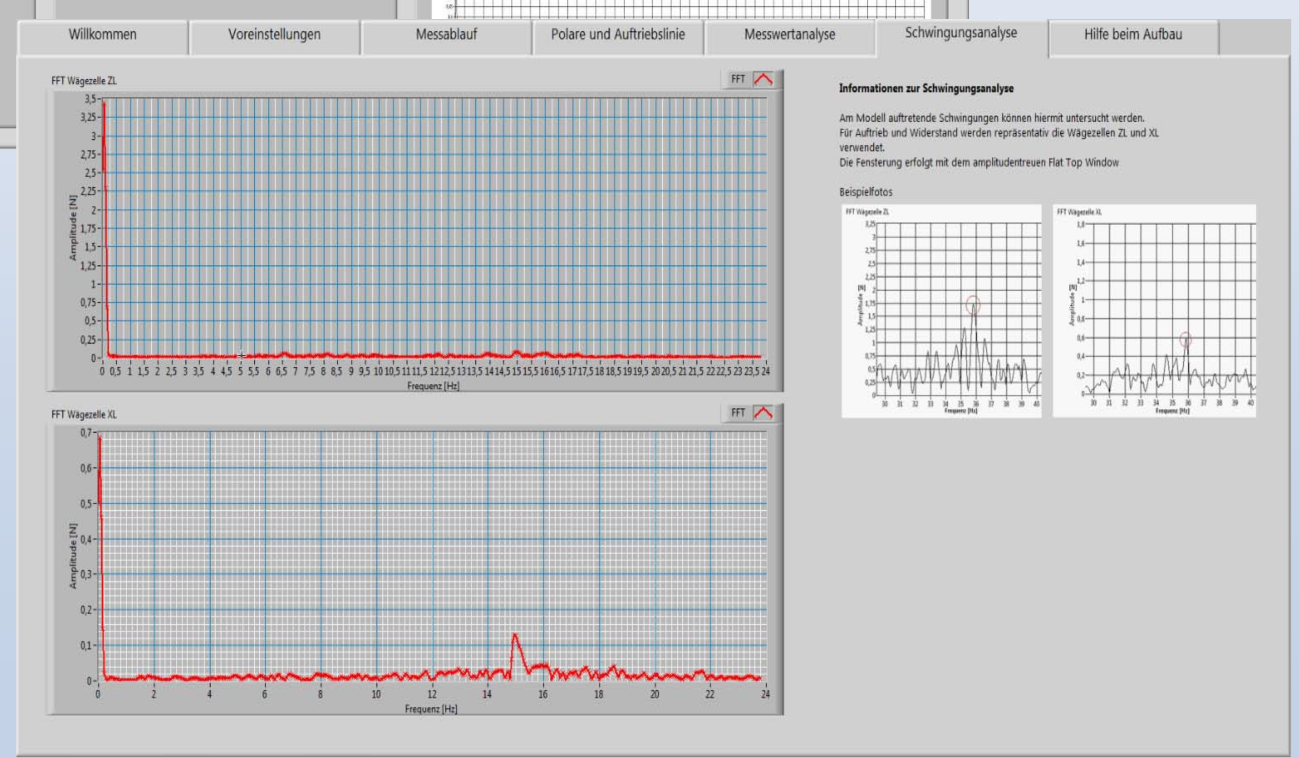

Fig. 3: Panel where the results of the vibration analysis are shown

3. Improved measurement

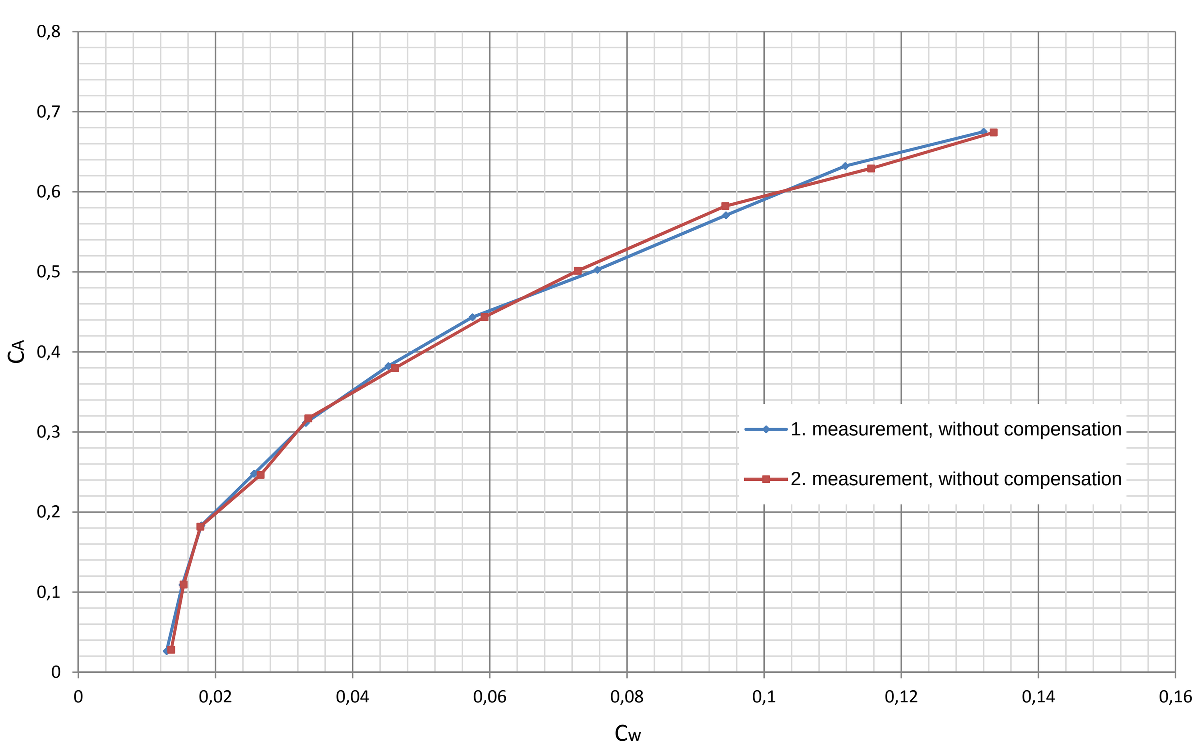

Fig. 4: Type-2-polar without compensation of the forces measured after zeroing the load cells

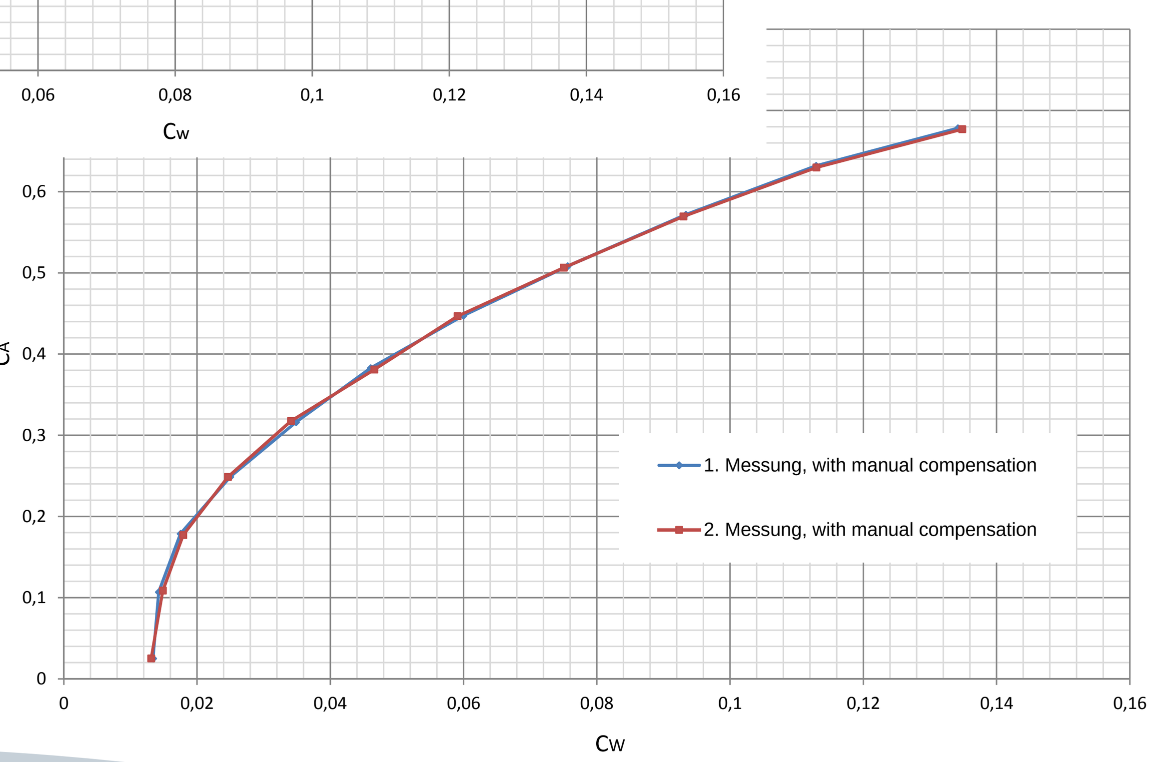

Fig. 5: Type-2-polar with compensation of the forces measured after zeroing the load cells

To improve the quality of the measurements, variations in dynamic pressure during measurement are taken into account and forces measured immediately after zeroing the load cells are now being compensated. The dispersion of the lift coefficient is reduced by 13,9 % whereas the variance of the drag coefficient has been decreased by 50,7 %.

4. Optimization results

shaping

Fig. 6: shaping FG_S1 applied on the model

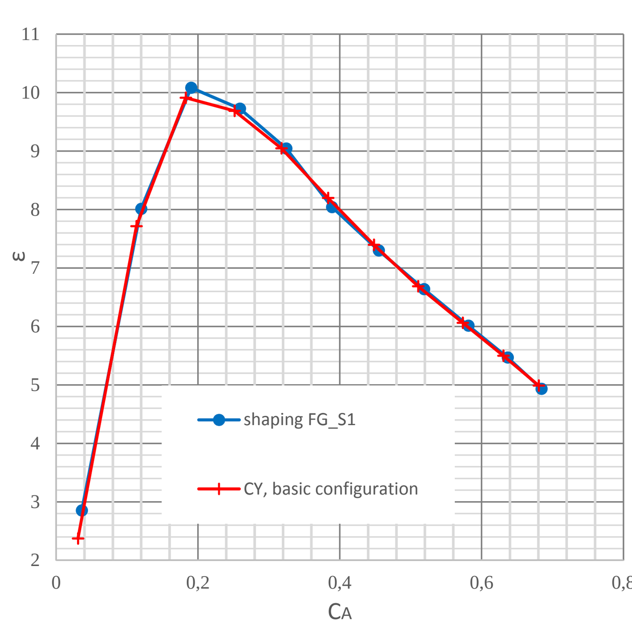

Fig. 7: glide ratio of the shaping modification compared to the basic configuration; Aerodynamic efficiency improvement 1,7 %

guiding plates

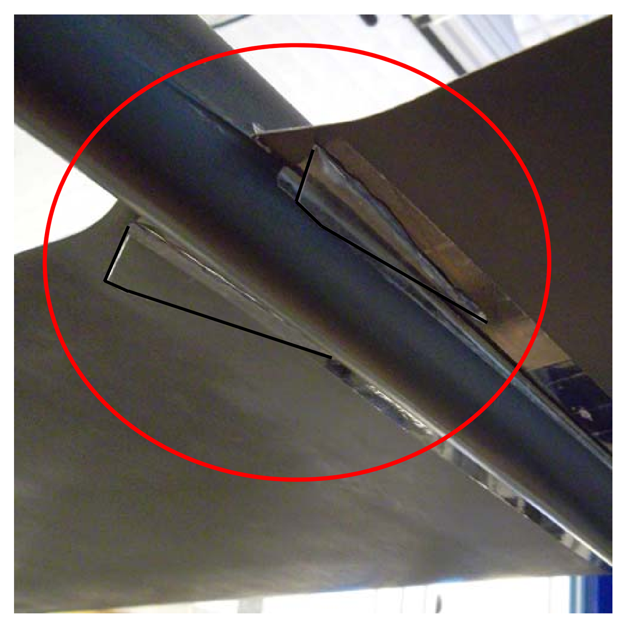

Fig. 8: guiding vanes LB_60x14_5_NR_U installed on the model

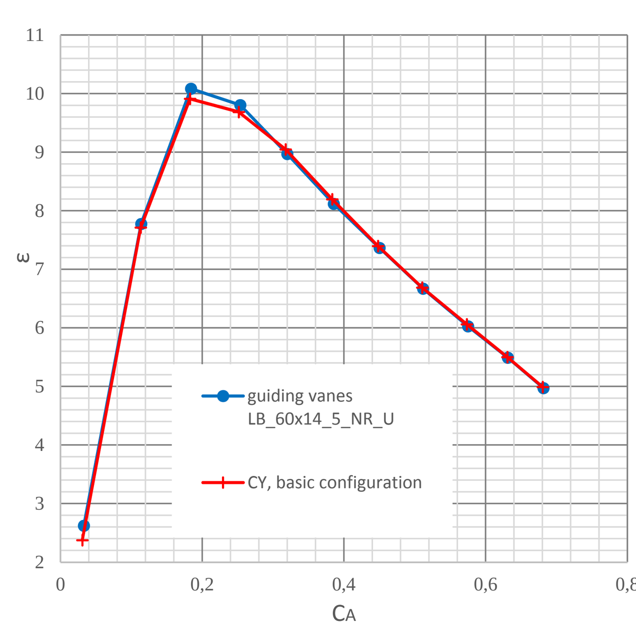

Fig. 9: glide ratio of the guiding vanes modification compared to the basic configuration; Aerodynamic efficiency improved 1,7 %, similar to the shaping modification