Labor Windkanal/Strömungsmesstechnik

Design of a backlash-free control unit and aerodynamic measurements at a wing-fuselage connection of a sailplane

Johannes Töpfl

Mechanical Engineering, Galgenbergstr. 30, D-93053 Regensburg, Head: Prof. Dr.-Ing. Stephan Lämmlein

e-mail: johannes.toepfl@gmx.de https://hps.hs-regensburg.de/las39261/

1. Outline

The target of this bachelor thesis is the design of a backlash-free control unit and aerodynamic measurements at a wing-fuselage connection of a sailplane in the Regensburg Wind Tunnel (RWT) with the objective to complete the automation of the measuring process and to raise the quality and reproducibility of the measuring results.



The RWT was put into operation in May 2006, consists of a closed circuit

2. New control units

In order to reach a higher repetitious accuracy and a backlash-free regulation of the angle of approach a new control unit was designed and mounted at the test stand. Through a crank, which is connected to a 24 V DC-linear actuator, the rotary axis turns. For a synchronous actuation of both units a new LabView Program was developed. This setup gives the possibility to change the angles with an accuraty of $0,01^{\circ}$.





(Göttingen-type) and has an exchangeable test section (open, ³/₄ open, closed). The covered speed range goes up to 48 m/s and the rate of turbulence reaches 0.5 % when operated in the open section.

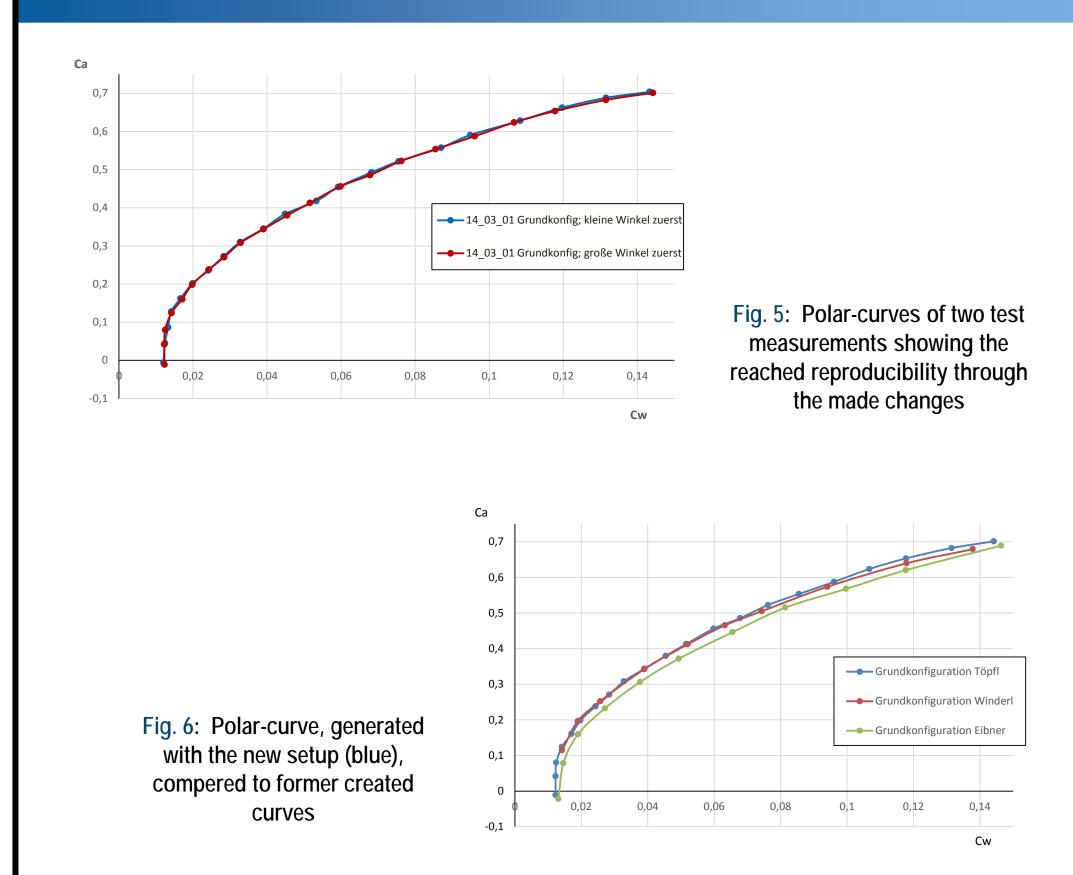
Fig. 1: Test stand in the old configuration mounted in the Regensburg Wind Tunnel

Fig. 2: Test stand with installed aircraft model and the new control units

3. Automated LabView program

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Messung Nummer Anzahl Messungen	Voreinstellungen Aktuelle Messwerte	Polare und Auftriebslinie Labor Windkänal/Stromungsmesstechnin
7 11		Messergebnisse
		Soll® Ist® Delta® Soll u Ist u ZI Zr XI Xr Ca Cw Roh dynvis
Anstellwinkelregelung Nullung Wägezellen	Timer bis WK beruhigt ist	12 11,99 ,00089: 10,13 10,14 2,115 2,093 0,3015 0,3074 0,5153 1,07456 1,118 ,944E-: • 10 9,983 1,01626 10,89 10,91 2,115 2,096 0,2716 0,2808 0,446 1,05851 1,118 ,944E-: •
Windregelung Kraftmessung	Sollwinkel Ist Anstellwinkel 6 5,98 Winkeldelta rechts links -0,002	Sollgeschwindigkeit Sollgeschwindigkeit WK-Geschwindigkeit WK eingeschaltet Fortschritt Geschwindigkeitsregelung I3,1 I3,2 Sollgeschwindigkeit Sollgeschwindigkeit Geschwindigkeit in m/s Sollgeschwindigkeit Mindkanalgeschwindigkeit
Messreihe starten		50- 45-
Messreihe nach diesem Messpunkt Abbrechen	Temperatur [*C] Luftdruck [Pa] 23,95 95746 Luftdrichte [kg/m ³] Feuchte % 1,1184 32,4	40- 35- 9 30- 25- 20-
Windkanlregelung Unterbrechen	dynamische Viskosität	15-

4. Test measurements



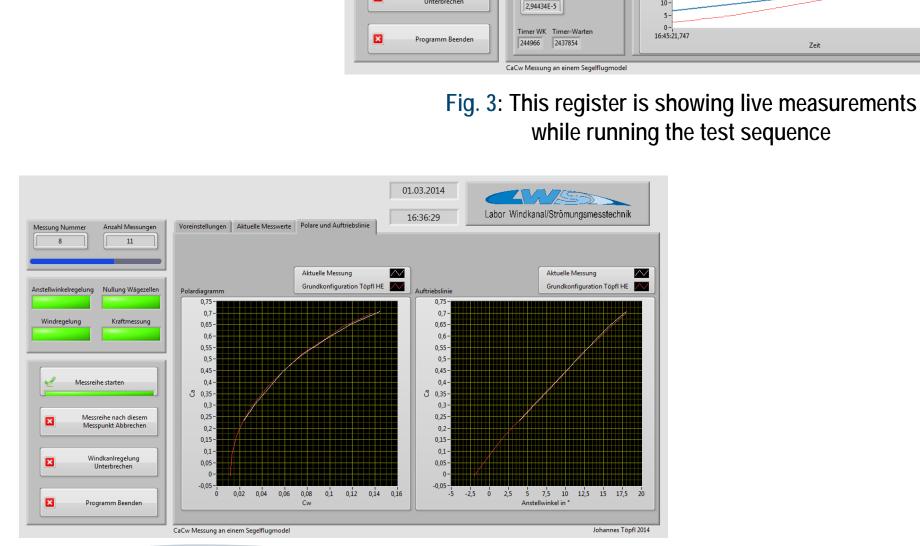


Fig. 4: Automated LabView program for the entire test sequence

A new LabView[®] application performs the entire test sequence on a complete automated basis. It records the lifting and resisting forces under several user defined angles of attack and displays online the coefficients of lift and drag on an appealing graphical user interface. The charts above show different test measurements. Fig. 5 shows two complete test series with a angle step of one degree between two points. The high consistency shows the reached reproducibility through the new control units and the automated LabView program.